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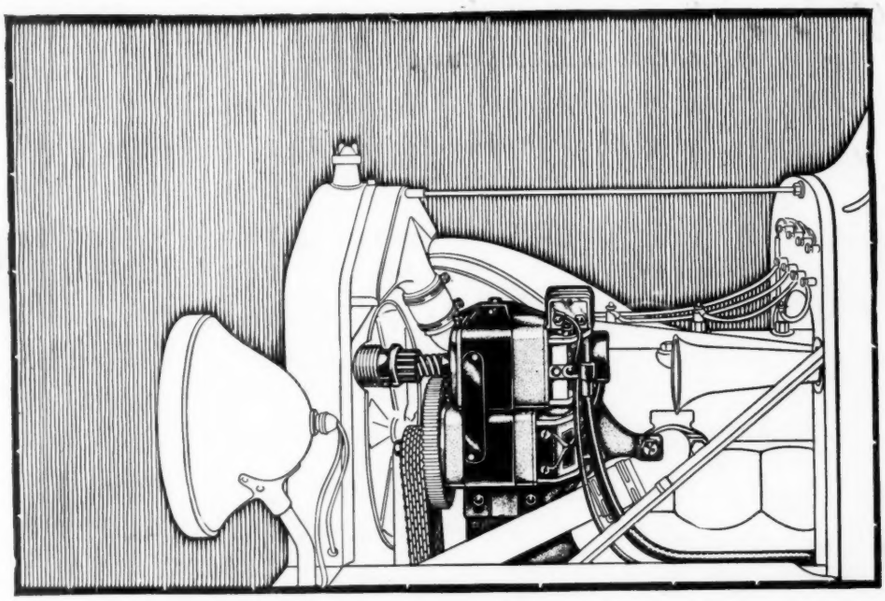

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The AUTOMOBILE

VOL. XXXV NEW YORK—THURSDAY, NOVEMBER 9, 1916—CHICAGO NO. 19

New Co. Takes Over Pierce-Arrow

Pierce-Arrow Motor Car Corp. Formed to Acquire Present Company Stock

NEW YORK CITY, Nov. 8.—The Pierce-Arrow Motor Car Co., Buffalo, N. Y., will be taken over by the Pierce-Arrow Motor Car Corp., which has been formed with 100,000 shares of 8 per cent convertible preferred stock and 250,000 shares of common without par value. A syndicate of New York bankers, headed by J. & W. Seligman & Co., will underwrite the new issues.

The new capital will be used to increase the factory facilities.

George K. Birge, now president of the company, and prominent in the wallpaper business, will retire, and Col. Charles Clifton, now treasurer of the concern and for several years head of the N. A. C. C., will succeed him. Otherwise there will be no change in the organization.

Details of the refinancing plan so far determined provide that the preferred stock will be redeemable at 125, and will be convertible for common on a share-for-share basis. It is also provided that for every dollar in dividends paid on the common stock in excess of $5 a share there shall be set aside $1 for the purchase of the preferred stock. This preferred stock, when acquired, will be exchanged for common, and will be considered available for any stock dividends which may be declared. All of the stock of the existing company will be acquired and arrangements are being made to retire the $1,250,000 of 6 per cent bonds on Feb. 1.

—

Firestone Capital to Be $15,000,000

AKRON, OHIO, Nov. 3—An increase from $4,000,000 to $15,000,000 in the capital of the Firestone Tire & Rubber Co., this city, was authorized yesterday by the stockholders. Two-thirds of this will be preferred and one-third common. Of the preferred, $5,000,000 is to be outstanding for the present. The nominal value of the common stock will be reduced from $100 a share to $10 a share and present shareholders will receive ten shares of new for each share held. Thus $3,000,000 new common will be outstanding. In addition the stockholders authorized the company to sell a maximum of 50,000 shares of new common at not less than $100 a share to employees of every grade. The company will begin dividends on the new common at the rate of $4 a year, which doubles the income of present stockholders. The shareholders authorized the company to set aside $1,000,000 for a fund to be used for insurance of employees, care of dependents, a pension plan, or such other welfare work as the directors shall determine.

The $5,000,000 preferred stock has been underwritten by the Cleveland Trust Co., the price to net the Firestone company par.

—

Dolbeer Willys-Overland Treasurer

TOLEDO, OHIO,, Nov. 9—F. K. Dolbeer has succeeded Walter Stewart as treasurer of the Willys-Overland Co. Mr. Dolbeer was formerly with the financial department of the Victor Talking Machine Co. Mr. Stewart continues as a director.

—

King Raises Car Prices $50

DETROIT, MICH., Nov. 6—The King Motor Car Co. has raised the prices of its products. The sedan selling for $1,900 now sells for $1,950 and the seven-passenger touring car and the three-passenger roadster, both of which were $1,350, have been raised to $1,400.

The company announces that there may be an additional increase in the near future, owing to the constantly increasing cost of materials.

Steinmetz's Electric To Be Built

Dey Corp. To Build Lowest-Priced Electric for Utility and Other Uses

NEW YORK CITY, Nov. 8—The low-priced electric utility vehicle which Dr. Charles Steinmetz, engineering authority of the General Electric Co., has been advocating for several years seems near the point of realization. Such a vehicle will be manufactured by the Dey Electric Corp., with offices at 45 Broadway, N. Y. This concern has engaged show space for the Grand Central Palace show, New York, where these new electric vehicles will be on display, and it is planned to have production under way for the 1917 market.

A comprehensive line of what is described as the lightest, lowest-priced and highest efficiency electric vehicle ever built will be manufactured. The Dey company has secured a factory in the Metropolitan zone, and will specialize on a runabout intended primarily for utility work, such as solicitors, etc. The car is not a passenger type, nor yet a truck, but essentially a utility vehicle. In addition to this runabout a closed type of passenger vehicle will be produced. The company will manufacture what might be termed a utility chassis suitable for taxicab purposes, as well as passenger bodies and light truck uses.

That the designs of this lowest-priced electric are practically completed is apparent in that the cars will be at the New York show. That the company will go forward with an interesting manufacturing program is also apparent in that it is strongly financed and presumably closely connected with one of the large electrical manufacturers.

The dream of the $500 electric, as it

(*Continued on page* 788)

Injunction Holds Up Ford Profits

Dodge Bros., in Suit, Seek to Prevent Investment of Surplus Money

DETROIT, MICH., Nov. 3—A temporary writ of injunction against Henry Ford to restrain the Ford Motor Co. from distributing and investigating as fixed capital assets surplus profits that would otherwise be available for dividends, was issued in the Wayne circuit court yesterday.

The plaintiffs, John F. Dodge and Horace E. Dodge, stockholders in the company and also owners of the Dodge Bros. automobile plant, want the accumulation of cash surplus in the form of special dividends.

The cause of the writ, according to the Dodge bill of complaint, was the declaration by Mr. Ford at the end of the last fiscal year, that no special dividends would be declared in the future by the company and that surplus earnings would be used to extend the business.

The announced policy of Mr. Ford to engage in a multiplicity of undertakings was declared in the bill to be reckless in the extreme and to jeopardize seriously the interests of the stockholders. The bill states that Mr. Ford is engaged in negotiations to invest several million dollars in iron ore mines in Northern Michigan or Minnesota, to build ships transporting ore to smelters and to erect steel manufacturing plants, "thereby depriving stockholders of fair and reasonable returns upon their investment."

Mr. Ford owns 58 per cent of the capital stock of the Ford Motor Co. The authorized capital stock was placed at $2,000,000 in 1908. John F. and Horace E. Dodge each held 1000 shares par value $100 at that time. The Dodge Bros. contend that though the regular monthly dividends—5 per cent, or 60 per cent a year—are large on the $2,000,000 capital stock, the dividends amount to only a fraction of 1 per cent of the capital actually invested when the surplus is taken into account. They also allege that they have been unable to make any arrangements to discuss the plan with Mr. Ford and that he claims that since the profits are to be represented by investments in plants and capital, the stockholders should have no right to complain.

The defendants will be given a hearing to show cause why a permanent injunction should not be granted.

Ford Replies to Charges

The present plans of expansion contemplated by the Ford Motor Co. are only in accordance with the past policies of the company. Dodge Bros. have drawn $5,571,500 in dividends from an investment of $10,000 and still have holdings valued at $50,000,000. Political motives are behind the suit against the Ford company. These are statements by Henry Ford and his attorney Alfred Lucking in their replies to the suit instituted by Dodge Bros.

"At the founding of the Ford business," said Mr. Ford, "Dodge Bros. invested $10,000, but I don't think any of it was in cash. That was in 1903, and since then they have drawn out dividends amounting to a total of $5,571,500 in cash. Of course, they still have a 10 per cent interest in the business that is worth, on their own valuation, $50,000,000. Besides that during the life of the company we have paid them more than $27,000,000 in cash for material and parts made for us, on which I believe they made a profit of at least $10,000,000. It is on the profit of these payments and their dividends drawn from the Ford Motor Co. that their present fortune is built."

Mr. Ford made light of the allegation in the Dodge bill of complaint that his proposed expansion would injure them.

—

Velie Companies May Consolidate

MOLINE, ILL., Nov. 6.—A special meeting of the stockholders of the Velie Motor Vehicle Co. will be held Nov. 14 at Moline, Ill., to consider a proposition to consolidate with the Velie Engineering Co. under a single corporation under the style Velie Motors Corp., with a capital stock of $2,000,000.

—

Madison Motors Acquires Anderson Plant

ANDERSON, IND., Nov. 3—The Madison Motors Co., this city, has consummated a deal for the acquisition of the buggy and wagon plant of the Anderson Carriage Co. This plant will be known as the Madison plant No. 2, and is to be used for manufacturing and finishing bodies and tops as well as final assembly. Plant No. 1, the old Rider-Lewis building, later occupied by the Nyberg company, will be used for chassis manufacturing and assembly only. The addition of the Anderson carriage plant gives the company additional floorspace of about 175,000 sq. ft.

—

Woodard Resigns from N. J. Car Spring

JERSEY CITY, N. J., Nov. 6—S. P. Woodard has resigned from the New Jersey Car Spring & Rubber Co., this city. He has been for the past 2 years general and sales manager of this company. He will not be actively connected with the company in the future.

His immediate plans are uncertain. It is rumored that he is negotiating with a large western tire manufacturer and may handle the entire output of mechanical rubber goods and tires.

United Motors Buys Houk Co.

Ninth Company To Be Taken Over—Management Will Remain Unchanged

BUFFALO, N. Y., Nov. 6—The Houk Mfg. Co., maker of Houk wire wheels, has been purchased by the United Motors Corp., which brings the total number of concerns owned by this corporation up to nine. As with its previous purchases the Houk company will continue as a separate manufacturing organization, and George W. Houk, founder of the Houk company and the one person in the U. S. A. responsible for the present status of wire wheels, will continue as manager.

As with other properties purchased by the United Motors, the Houk Mfg. Co. will be largely increased. There are 500 men at present on the payroll but this number will be increased by 300 at once. Previous to Nov. 1 the capacity was 1000 wheels per day, but it is now up to 2200, and it will be 4500 per day by Feb. 1, according to present plans.

Approximately $1,000,000 will be expended on new buildings and equipment, the work connected with which will be started at once. The capacity of the plant will be doubled.

The progress of the wire wheel in America has been almost entirely connected with the name of George W. Houk. His work in this country started as a licensee of the Rudge-Whitworth company of England. He started manufacture Sept. 23, 1913, and first deliveries were made in February, 1914. To-day the company has an account with eighty-five different car makers, and during the last 12 months has averaged approximatelly 800 wheels per day. The company is at present manufacturing 40 per cent of the wire spokes used in its wheels. The spoke manufacture was started in March, 1915, when Houk purchased the American Spoke and Nipple Co., of Detroit, and moved the factory to Buffalo.

The month of October was the largest month in the history of the company. Total shipments were 19,461 wheels. On Oct. 24 unfilled orders on the books of the company totalled 197,205 wheels.

—

M. A. M. Annual Banquet Jan. 10

NEW YORK CITY, Nov. 3—The Motor and Accessory Manufacturers will hold their annual banquet at the Waldorf Astoria Hotel, this city, on Jan. 10. W. M. Sweet, former manager and now assistant to the president of the United Motors Corp., has been elected chairman of the banquet committee.

Fisher Body Buys Regal Plant

Also Adding Two Buildings Costing $260,000 and $225,000 —In Operation Next May

DETROIT, MICH., Nov. 2—The Fisher Body Corp. has purchased the factory of the Regal Motor Car Co. located opposite the main Fisher plant here. The Regal unit is already in active operation and with this additional capacity, the Fisher Co., it is stated, is now turning out about 60 per cent of all the closed automobile bodies being made in the United States.

Notwithstanding the increased production the corporation was not able to accept contracts recently offered them to furnish bodies to two of the large producers and therefore is adding to its already extensive plant in Detroit two large buildings, one costing $260,000 for general body construction and one costing $225,000 for service and repair departments, both of which will be in full operation next May.

—

Charter Oak Car Under Way

HARTFORD, CONN., Nov. 6—The Eastern Motors Syndicate, organized some time ago for the development of a high-grade automobile, has the designing work well advanced and plans are practically completed for construction of a building to meet the manufacturing requirements. The car will be known as the Charter Oak in honor of the city of Hartford, where the famous tree was located. The manufacturing organization will be known as the Eastern Motors, Inc., which will take over the present syndicate and has been incorporated for $1,000,000.

—

Ricker Heads Ricker Oil Co.

INDIANAPOLIS, IND., Nov. 7—Chester S. Ricker, consulting engineer, was elected president of the Ricker Oil Co., which was recently incorporated at Indianapolis. Associated with him are S. H. Penfield, vice-president of the Sakusvyrt Wheel & Mfg. Co., Jamestown, N. J., and president of the Peru Auto Parts Mfg. Co., Peru, Ind., as vice-president and Robert B. Denham of Indianapolis as treasurer.

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Chalmers Motor Corp. Chartered

ALBANY, N. Y., Nov. 3—The Chalmers Motor Corp. formed last week to succeed the Chalmers Motor Co. as a result of the refinancing of the company, has filed articles of incorporation here. The company has 600,000 shares without par value. The directors are Benoni Lockwood, F. A. Gaynor and R. G. Goad, of 43 Cedar Street, New York City.

The Chalmers stock is now on the Curb market, having been offered by J. S. Bache & Co. and C. D. Barney & Co. at $35 a share. Common shareholders, according to the new financing plan, will receive for each share held four shares of the new, while preferred shareholders may have their shares redeemed at $115 or exchange on the redemption basis, about 3½ shares of the new for each share held. The new corporation will keep 135,000 shares in the treasury and use 200,000 shares for exchange purposes. Net proceeds of the 265,000 shares offered, or more than $9,000,000, will go into the treasury.

—

International Motors Co. Reorganization Plan Is Approved

NEW YORK CITY, Nov. 6—The reorganization plan of the International Motors Co. has been approved by the stockholders and creditors, over 93 per cent of the preferred and 94 per cent of the common being deposited with the two committees. A reorganization plan was adopted in September by which a new company of the same name will be formed to take over the present concern. Additional capital of $1,500,000 was raised and the $2,881,000 notes maturing the first of this month was obliterated.

By this plan the new company's securities will be exchanged on an equal basis for those of the present organization and will consist of $4,381,000 in 7 per cent cumulative first preferred stock, $2,723,000 second preferred and 53,638 shares of common of no par value. Of the first preferred, $2,881,000 is to go to the holders of the notes at par, and the balance will be issued for cash to provide working capital, being offered to stockholders at par with common stock thrown in. Holders of the present $3,600,000 preferred will receive 60 per cent in new second preferred and 10 per cent in new common. For the outstanding $5,628,000 common, 10 per cent in second preferred and 10 per cent in new common is to be exchanged.

—

Rochette Sails for S. A.

NEW YORK CITY, Nov. 4—Edward Rochette, special representative of the Willys-Overland Co., sailed to-day on the steamer "Pastores" for South America by way of Panama Canal and the West Coast. His destination is Valparaiso, Chile. Mr. Rochette has represented Willys-Overland for some years in the South American field, where he makes headquarters at Buenos Aires.

—

Winckler with Pittsburg Engine

RACINE, WIS., Nov. 6—A. E. Winckler, formerly chief engineer of the automobile department of the J. I. Case T. M. Co., Racine, has become chief engineer of the Pittsburg Model Engine Co., Pittsburg.

S. K. F. Controls Hess-Bright?

Control of Conrad Ball Bearing Patent License Royalties a Part of Transaction

NEW YORK CITY, Nov. 8—Control of the Hess-Bright Mfg. Co., Philadelphia, Pa., manufacturer of ball bearings, has been secured, it is rumored, by the same financial interests that own the S. K. F. Ball Bearing Co., Hartford, Conn. It is understood that over 50 per cent of the Hess-Bright stock has been secured by the latter concern. No statement has been issued by the S. K. F. company. It is assumed the Hess-Bright factory in Philadelphia will be operated as formerly, and perhaps on an increased scale.

Conrad Patent Included

With the purchase of the Hess-Bright company goes the now celebrated Conrad patent, which was adjudicated in the courts a year ago and which patent has been a valuable asset of the Hess-Bright company. This patent refers to an annular type of bearing in which the balls rotate in a groove presenting a continuous surface. Several bearing concerns have been licensed by Hess-Bright under this patent, these including: New Departure Mfg. Co., Standard Roller Bearing Co. By securing control of the basic patent the S. K. F. Ball Bearing Co. will receive all royalties accruing therefrom. These royalties are a large figure at present and will naturally increase with the greater development of the industry.

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Republic Truck Shipments Gain

ALMA, MICH., Nov. 3—Shipments of the Republic Motor Truck Co. in October amounted to 626 trucks, compared with 190 in 1915 and thirty-five in 1914. For the first 10 months of this year the shipments were 4902 trucks, against 1442 in the corresponding period of last year.

—

Commercial Auto Body Co. Formed

BAY CITY, MICH., Nov. 1—The commercial Auto Body Co., this city, has been formed to manufacture commercial bodies for Fords. The incorporators are W. B. Fitzgerald, Henry Kinney, Robert Woodworth, A. E. Hubbell, Adam Schepper, Edward Covert, W. P. Kavanagh and W. H. Kelly.

—

Gasco Mfg. Co. Organized

LANCASTER, PA., Nov. 1—The Gasco Mfg. Co. has been formed in this city to manufacture specialties for Fords. R. W. Shreiner is president and general manager. One of the articles to be manufactured is a new cowl dash light for Fords. This company will also put out a new heater for Fords.

Supreme Court Hears Tax Case

Arguments Heard in N. J. Test on Legality of Taxing Non-Residents

WASHINGTON, D. C., Nov. 8—Whether a State can tax an automobilist from another State for the use of its roads will be decided shortly by the United States Supreme Court, the argument for the so-called New Jersey test case prepared by the American Automobile Assn. and the National Automobile Chamber of Commerce having been presented Oct. 31. The case is that of Frank J. Kane against the State of New Jersey, based on his interstate journey from New York to Pennsylvania, which resulted in his being convicted and fined for violating three provisions of the New Jersey law, first that he had failed to register his car in New Jersey; second, that he failed to pay the tax imposed on non-residents; and third, that he failed to file with the Secretary of State a power of attorney.

The American Automobile Assn. was represented by John W. Griggs, former attorney general of the United States, and Charles Thaddeus Terry appeared for the N. A. C. C. The argument presented by them set forth these contentions:

1—It being admitted in the record that the fees charged for the operation of automobiles over the highways of New Jersey result in a large surplus revenue to the State over and above the expenses of examination, licensing, registering and inspecting the automobile traffic on the highways, the charge is a tax which is not in conformity with proper tax laws in that the motor vehicle is burdened with a heavy impost, irrespective of its value, whereas other property is taxed only according to its value.

2—The so-called "license-fee" being in reality a tax, is unreasonable and void as such tax because even assuming that it is a charge for the use of a special facility, to wit—the improved roads furnished by the State of New Jersey, it is unreasonable because a lump sum is charged irrespective of the question how much or to what extent the automobile uses the roads. For example, the same fee is charged for the right of the automobile to go a few hundred yards, as is charged to the automobile which traverses the roads of the State for a whole year covering thousands of miles. Thus the charge is unequal, disproportionate and not upon any scientific or logical basis, and, therefore, improper and illegal.

3—The improved roads of a State are not a "special facility" afforded by the State to automobiles, but their construction and presentation to the public are simply governmental functions which should be paid for out of the general tax fund in the same way that the police force and the fire department are afforded for the use of all the citizens irrespective of the amount of use. Therefore, no special charge or impost can be levied for their use to any particular class of users.

4—That the law is discriminatory and class legislation in that even assuming that the license fee is a charge for the use of the roads, it is not imposed equally upon all the users of the roads. Horse-drawn vehicles use the roads and use up and destroy the roads in a large degree, and, therefore, if the tax were to be an equal and uniform tax, it must be imposed upon horse-drawn vehicles as well as upon automobiles.

5—The requirement that before any non-resident shall use the highways of the State, he must file a power of attorney with the Secretary of State, and authorize such secretary to receive service of process for him, is ousting him of his domicile and imposing a requirement which is not imposed upon any other class of non-resident citizens of the United States going into the State of New Jersey. It is assuming in advance that the automobile user is likely to commit a criminal act which is absurd on the face of it. He is no more likely to commit a criminal act than any other non-resident entering the State of New Jersey, and even if he were, such a method of enforcing the criminal law is unknown to our jurisprudence.

6—The requirement of a power of attorney from non-residents and the imposition of a tax upon non-residents and the requirement that before the highways shall be used by non-residents they shall make application and take out registration, are burdens on interstate commerce which the Constitution of the United States forbids under the Fourteenth Amendment thereof.

It is expected a decision will be rendered by the court before the holiday recess.

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Ypsilanti Motor Truck Co. Organized

DETROIT, MICH., Nov. 6—Stockholders of the Globe Motor Truck and Body Co. met Nov. 3 and organized the Ypsilanti Motor Truck Co. with a capitalization of $100,000.

The board of directors includes: H. R. Scoville, Charles N. Haviland, D. L. Davis, F. W. Paton, Frank R. Welsh, H. F. Shaefer and Gilbert E. Porter, all of Ypsilanti. A factory will be built.

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Steinmetz Electric To Be Built

(*Continued from page* 785)

was styled 2 years ago, has been a cherished matter with Dr. Steinmetz. It has been known for several years that he has been perfecting features of design which would make it possible to produce a utility electric vehicle at practically the same price as the cheaper gasoline machines. Dr. Steinmetz strongly advocated this type of vehicle before the different electric interests, as well as before the electric vehicle manufacturers. It was generally considered impossible to build such a vehicle that would give the desired service. The possibility of producing such a vehicle resulted in many strenuous arguments on convention floors, between central station concerns, or companies manufacturing electric current, and those engaged in vehicle manufacture. The central station interests were strong for such a vehicle, as it would naturally be a great source of revenue if manufactured in large quantities. On the other hand, electric vehicle makers were catering to public requirements for larger and more luxurious types of electric vehicles.

The price of the new lowest-priced electric to be built by the Dey corporation has not been determined, but it is understood that it will be under $1,000 and that eventually the dream of Dr. Steinmetz for a $500 vehicle may be attained, if not carried further.

—

$9,000,000 for Freight Cars by M. C.

DETROIT, Nov. 3.—The Michigan Central Railroad has just closed a contract for the construction of 6750 freight cars, of which 4000 will be cars equipped for carrying automobiles.

Overland Convention in Dec.

Co. Will Be Host to 4000 Dealers of U. S. and Canada

TOLEDO, OHIO, Nov. 4—December is to be the month for the grand welcome to the 4000 Overland dealers of the United States and Canada, and plans are now being formed to make it an epochal month in the history of the big Willys-Overland organization. Beginning about Dec. 4 and ending Dec. 23 there will be a series of gatherings of the Overland dealers here. It is planned to make it the biggest event of its kind ever held in the automobile industry.

Entertainment in Relays

The country is being divided so that the agents from one section will follow those of another every few days until the entire organization has been entertained. Each division will spend about 2 days and 3 nights in the city, and there will be visits to the factory and talks in the new administration building.

President John N. Willys plans to be on hand, so that he may have a chance to talk to all his dealers and give them some word of encouragement for the forthcoming season. At that time he will be ready to announce what the production is going to be, and if there is to be any change in the style of models, prices, etc. From the factory no inkling has been given out as to any proposed announcements, but it would not surprise many of the dealers if new models or new prices were planned, and they were let into the secret just before the big shows, so that they could begin their operations for the new year.

The factory will be the host of the visiting dealers while they are in this city, but the men will pay their own fares to and from their homes. It has been arranged that the dealers will get the benefit of excursion rates.

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Kuhn Is Four-Wheel-Drive Tractor

SEATTLE, WASH., Nov. 4—The Kuhn Tractor Truck Co. has been organized here to manufacture a tractor truck, the chief feature of which is that each wheel operates independently of the other. It has a four-wheel drive and power may be applied to all wheels or to each one. There is a positive power control and some of the wheels may be buried in the mud, but the power can be applied to the free wheels alone and no slipping results. The truck is in this way pulled out of difficult positions. A four-wheel brake is another unique feature which equalizes the tension on all wheels at the same time.

127 New Accessory Exhibits

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Makes Total of 340—Every Inch of Space Taken—Car Space All Filled

NEW YORK CITY, Nov. 8—The Motor and Accessory Manufacturers, which recently allotted space in the national automobile shows to 115 members, has added 127 concerns not members of the association. With ninety-eight car exhibits, the total reaches 340. Every inch of available space for both the local and Chicago national shows has been allotted. For the first time in the history of the national shows all the space allotted to automobile exhibitors has been filled, and at the first drawing.

The new accessory exhibitors follow:

	New York	Chicago
Acieral Co. of America, New York.	X	X
Adams & Findlay, New York	X	
Adamson Mfg. Co., East Palestine, Ohio.	X	
J. Alexander Mfg. Co., New York.	X	
American Bureau of Engineering, Inc., Chicago	X	
American Express Co., New York.	X	
Armstrong Cork Co., Pittsburgh	X	X
Asch & Co., Inc., New York	X	
Auto Gear Co., Inc., New York	X	
Auto Gear & Parts Co., Chicago		X
Automatic Transmission Co., Inc., New York	X	X
Barnes Foundry Co., Jersey City	X	
Bausch Machine Tool Co., Springfield, Mass.	X	
Bay State Pump Co., Boston	X	X
Becker Bros., Inc., Chicago	X	X
Benjamin Electric Mfg. Co., Chicago		X
Bournonville Welding Co., New York.	X	
Brunswick - Balke - Collender Co., New York	X	X
Chalsmith Co., Chicago	X	X
Class Journal Co., New York	X	X
Continental Motor Equipment Co., New York	X	
Corcoran Mfg. Co., Cincinnati	X	
Cox Brass Mfg. Co., Albany	X	
Craftsman Motor Corp., Chicago	X	
Crew Levick Co., Philadelphia	X	
Culver Stearns Mfg. Co., Worcester, Mass.	X	
Curtis Pneumatic Machinery Co., St. Louis	X	X
Cutler-Hammer Mfg. Co., Milwaukee.	X	
Detroit Battery Co., Detroit	X	X
Disco Electric Starter Corp., Detroit.	X	X
Drabek Equalizer Co., Cleveland	X	
Dunham Piston Ring Co., New York.	X	
Eastern Rubber Co., Philadelphia	X	X
Essex Rubber Co., Trenton, N. J.	X	
Eureka Rim Compressor, Inc., Addison, N. Y.	X	
J. H. Faw, Inc., New York	X	
Fitzgerald Mfg. Co., Torrington, Conn.	X	
Peter A. Frasse & Co., New York.	X	
Fulton Co., Knoxville, Tenn	X	X
General Tire & Rubber Co., Akron.	X	
Gibson-Hollister Mfg. Co., Jamaica Plain, Mass.	X	
Gould Compensating Gear Co., Redding, Cal.	X	X
Emil Grossman Mfg. Co., Inc., Brooklyn	X	
H. & D. Co., Goodland, Ind	X	X
H. & D. Carburetor Co., New York.	X	
Hart-Bell Co., New York	X	
Hill Insulating & Mfg. Corp., New York.	X	
G. L. Holmes, New York	X	
Holt-Welles Co., Inc., New York	X	
Hoover Spring Co., San Francisco.	X	X
Houpert Machine Co., New York	X	
Howe Mfg. Co., Chicago	X	X
W. H. Howell Co., Geneva, Ill.		X
Humboldt Machine & Stamping Co., Long Island City, N. Y.	X	X
Humphrey's Sales Corp., New York	X	
Improved Gauge Mfg. Co., Syracuse.	X	
Inland Machine Works, St. Louis	X	X
International Coat Co., New York.	X	
Interstate Electric Co., New Orleans.	X	X
J. H. Tonneau Shield Co., New York	X	X
Juhasz Carburetor Co., New York	X	
K-W Ignition Co., Cleveland	X	X
Kemco Electric Mfg. Co., Cleveland	X	X
Lane Bros. Co., Poughkeepsie	X	X
L. Lawrence & Co., Newark, N. J.		X
Lowe Motor Supplies Co., New York.	X	
McKinnon Dash Co., Buffalo	X	
McQuay-Norris Mfg. Co., St. Louis.	X	X
Paul M. Marko, Brooklyn, N. Y	X	
Marvel Accessories Mfg. Co., Cleveland	X	X
Master Spark Co., Chicago	X	X
Mattson Rubber Co., Lodi, N. J	X	
S. Whyle Merritt Co., New York	X	
Metal Specialties Mfg. Co., Chicago.	X	
Metal Stamping Co., Long Island City, N. Y.	X	X
Charles E. Miller, New York	X	
Miller Transmission Co., New York.	X	
Moreau & Pratt, Inc., New York	X	
L. J. Mutty Co., Boston, Mass	X	
Myle-Mayker Co., Chicago	X	X
New Era Spring & Specialty Co., Detroit.	X	X
Packer Auto Specialty Co., New York	X	
Parker Rust Proof Co. of America, Detroit.	X	X
Perkins-Campbell Co., Cincinnati	X	
N. A. Petry Co., Philadelphia	X	
Philadelphia Storage Battery Co., Philadelphia.	X	X
Phillips Auto Seat Cover Co., New York.	X	
A. J. Picard & Co., New York	X	X
Pittsburgh Electric Specialties Co., New York	X	
Pouvailsmith Corp., Poughkeepsie.	X	X
William E. Pratt Mfg. Co., Chicago	X	X
W. E. Pruden Hardware Co., New York	X	
Reliable Auto Heater Co., Cleveland.	X	X
P. Rielly & Son, Newark, N. J	X	
Rubber Insulated Metals Corp	X	X
W. A. Schleit Mfg. Co., Inc., Syracuse	X	X
Scully & Brandt, Inc., New York	X	
Seaboard Industrial Products Co., New York.	X	
Sipp Machine Co., Paterson, N. J.	X	
Small & Singleton, Brooklyn, N. Y.	X	
Smith Form-A-Truck Co., New York.	X	
Spray Primer Co., Boston	X	X
John T. Stanley Co., Inc., New York.	X	
Stentor Electric Mfg. Co., New York	X	
Sternberg & Co., Chicago		X
Stevens & Co. New York	X	X
F. W. Stewart, Chicago	X	
Charles O. Tingley & Co., Rahway, N. J.	X	
Tobey Polish Co., Chicago		X
Triple Action Spring Co., New York.	X	
Triple Action Spring Co., Chicago		X
Tuthill Spring Co., Chicago		X
United Engine Mfg. Co., Hanover, Pa.	X	X
Universal Motor Products Co., Minneapolis		X
U. S. Air Compressor Co., Cleveland	X	X
U. S. Gauge Co., New York	X	X
U. S. Metal Goods Co., Cleveland	X	X
Van Cleef Bros., Chicago		X
Wales-Adamson Co., Chicago		X
Walker Mfg. Co., Racine	X	X
Wasson Piston Ring Co., New Brunswick, N. J.	X	
Water Gas Carburetor Co., Kansas City	X	X
Weaver Mfg. Co., Springfield, Mass.	X	X
Westfield Chemical Co., Westfield, Mass.	X	
Weston Electrical Instrument Co., Newark.	X	
C. A. Willey Co., Long Island City, N. Y.	X	
"X" Laboratories, Boston	X	X

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Brewster & Co. Joins N. A. C. C.

NEW YORK CITY, Nov. 6—Brewster & Co., Long Island City, carriage builder, and which 2 years ago began the making of a car with a Knight engine, has been admitted to membership in the National Automobile Chamber of Commerce.

Time Payment Plan for Trucks

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Guaranty Securities Corp. Method Is Similar to Passenger Car Scheme

NEW YORK CITY, Nov. 6—A time-payment plan for truck sales has just been adopted by the Guaranty Securities Corp., which about a year ago entered the field to finance the sale of passenger cars by dealers. The new plan is similar to the passenger car plan, which was described in THE AUTOMOBILE for April 6, but the percentage of cash demanded is not so great because the truck is strictly a necessity and pays for itself.

The status of the Guaranty business may be surmised from its statement that since Jan. 1 it has financed $18,000,000 of passenger car business. The truck plan has been in operation but a few days.

Collects 25% Cash

For a general understanding of the plan it may be stated that when the dealer sells a truck he collects 25 per cent cash from the customer and is paid nearly all the balance by the Guaranty corporation, which collects from the truck buyer through notes. For handling and for adequate insurance a Guaranty charge is made and is paid by the truck buyer. A small part of the sales price of the truck is retained by the Guaranty corporation until the buyer's notes are all paid, but on his deferred payment the dealer gets the prevailing rate of interest.

When a dealer sells a truck of which the f.o.b. factory list is $1,200 the dealer adds freight and the Guaranty charge in arriving at the "Buyer's Delivered Price." This Buyer's Delivered Price is the basis of figuring. It is as shown in the plan outlined in the table on page 795.

Several terms in the plan may require explanation as may also some of the steps.

Delivered Price to the truck buyer consists of the list price of the truck, including body and chassis, the freight from the factory to the dealer and the Guaranty charge. If the truck is an electric the delivered price may include the battery provided the Guaranty corporation approves of the make of battery. This, in effect, means that the battery may be included if it is supplied with the truck as shipped from the factory.

Guaranty Charges are approximately 3 per cent, but for convenience in figuring the prices of trucks have been graded in units of $250 and a flat price arrived at for each class, as is shown by the table of charges on page 795.

(*Continued on page* 795)

120,000 Cars in Canada

Ontario Leads with 50,000—100,000 Cars To Be Produced There in 1917

TORONTO, ONT., Nov. 3—Government registration returns indicate that there are approximately 120,000 cars owned in Canada to-day—an increase in round figures of 45 per cent since a year ago. Ontario with approximately 50,000 cars, maintains her position as the banner automobile province of the Dominion, as in Ontario are owned more than three times the number of cars owned in any other province, and approximately 42 per cent of all the cars in the Dominion.

This large increase in the number of cars in Canada is primarily attributable to two things. The first is, of course, national agrarian, industrial and commercial prosperity, and in the second place to the inauguration in Canada, only now getting under way, of the aggressively progressive intensive car merchandising methods long since successfully in operation in the States.

With every facility to speed this development, Canada has over 400,000,000 acres of fertile wheat land awaiting cultivation—the only great arable tract of land undeveloped in the world under salutary democratic government.

The automobile plants of Ontario will build during the coming year over 100,000 cars, according to their production schedule.

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Pennsylvania Fees for Good Roads?

PHILADELPHIA, PA., Nov. 3—Announcement was made by Governor Brumbaugh, of Pennsylvania, at the opening exercises of the new William Penn Highway at Easton, that a bill would be submitted to the next Legislature providing that all money received by the State from licenses will be turned over to the highway department for new highways. He also announced that the bill would provide for an annual contribution by the State of $5,000,000 for that purpose. The William Penn Highway which was dedicated runs from Pittsburgh to Easton.

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Canada Uses 30 per Cent More Gasoline

KINGSTON, ONT., Nov. 4—According to U. S. Consul Felix S. S. Johnson at Kingston, the consumption of American gasoline in Canada this year has been greater than ever before. To date the amount used is 25 to 30 per cent larger than last year. In the average year the consumption in Canada is about 60,000,000 gal. With an increase of 25 per cent the consumption this year will be about 75,000,000 gal. Throughout the period of high prices gasoline has been cheaper in Ontario than elsewhere.

For the purposes of comparison with Canadian prices the imperial gallon must be used as a basis. This is one-fifth larger than the wine gallon and would bring the American price to 27.6 per gal. To this must be added the duty of 2.5 cents per gallon and freight to the amount of 1.25 cents per gallon. This would bring the cost of Canadian gasoline to 31.35 cents per gallon from tank to garages. The war tax of 7½ per cent is also levied. There are indications that present war prices will go down as a result of poor weather and the increased production of crude oil.

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New Parking Law for Baltimore

BALTIMORE, MD., Nov. 4—Baltimore's new automobile parking law went into effect last week and scores of automobilists were arrested in all parts of the city.

The law requires that no vehicle of any kind be left standing on any streets during the day longer than 2 hr. at a time, nor longer than 3½ hr. at night. The biggest objection raised against the ordinance is that it affects unfrequented streets of the city as well as those on which the traffic is heavy.

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Waukesha Motor Promotes Industrial Education

WAUKESHA, WIS., Nov. 4—A unique plan for the promotion of industrial education has been evolved by the co-operative effort of the Waukesha board of industrial education and the Waukesha Motor Co., motor manufacturer, with the approval of the Wisconsin State board of industrial education. By this plan it will cost the city only a nominal sum for high class instruction, and no investment or upkeep for facilities is required. The Waukesha Motor Co. has permitted the local board to establish a school organization directly within its big plant. The school is open to any person who qualifies by being 16 years of age or over. Part of the time during each day will be devoted to actual teaching and instruction related to the general problem of gas engineering, while the remainder of the day will be devoted to the teaching of citizenship and to diversified employment within the factory itself. Enrollment is open to any young man, whether at present employed by the Waukesha Motor Co. or not, and full wages will be paid for the time devoted to schooling, the same as for employment.

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Pennsylvania License Fees $2,301,240

PHILADELPHIA, PA., Nov. 3—Up to Oct. 30, the Pennsylvania State Highway Department received $2,301,240 in license money. For the entire 12 months of 1915 the amount was $1,650,000.

Mass. Registrations Gain 31,000

113,786 Passenger Cars—17,682 Trucks—8864 Dealers' and Makers' Cars

BOSTON, MASS., Nov. 4—Registration figures in Massachusetts continue to set new records and the Highway Commission has announced that for the first 10 months of this year the relative proportion of increase has been greater than in the past 2 years. Up to Nov. 1 there were 113,786 passenger cars, 17,682 commercial vehicles and 8864 cars belonging to manufacturers and dealers. This gives a total of 140,332 machines. There were 162,046 licenses issued and the receipts have run up now to $1,537,737. These figures exceed expectations. The figures show a gain of some $300,000 in fees over the same time a year ago, and something like 31,000 more cars. The following table gives the comparative figures for the same periods for the past 3 years:

	1916	1915	1914
Automobiles ...	*131,468	†100,500	‡76,145
Manufacturers or dealers....	1,966	1,732	1,514
Licenses, operator and chauffeur ...	55,045	42,325	25,651
Operator and chauffeur renewals	107,001	85,865	70,166
Examinations .	11,179	9,693	.....
Total receipts..	$1,537,237	$1,189,010	$916,712

*Includes 17,682 commercial vehicles.
†Includes 11,564 commercial vehicles.
‡Includes 8,078 commercial vehicles.

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Automobile Telegraphic Code on Market

SAN FRANCISCO, CAL., Nov. 6—The Code Publishing Co. has placed on the market a standardized automobile telegraphic code which is the work of Robert E. Pye. The book has been endorsed by the National Assn. of Automobile Accessory Jobbers, which recommends its use. The code is divided into three divisions: Merchandise, in which is coded supplies, accessories and car models; general phrases, covering orders, shipping, prices, general communications, etc.; the third division is tables of measurements, money, transportation, etc. The book will be distributed by Commissioner W. M. Webster of the N. A. A. A. J., Chicago.

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Engel to Promote Oldsmobile Sales

LANSING, MICH., Nov. 6—J. W. Engel has been appointed manager of the sales promotion department of the Olds Motor Works. Before entering the automobile field Mr. Engel was in newspaper work and for several years filled an executive position with the U. S. Postal Service.

Para Needs More Good Roads

Gaidzik, Representing Nash in S. A., Finds Little Future Without Them

NEW YORK CITY, Nov. 4—George W. Gaidzik, South American representative of the Nash Motors Co., arrived in this city yesterday after a 10 months' business trip along the East Coast of South America, where he has been establishing agencies and demonstrating the Jeffery Quad and the Jeffery passenger car. During his recent trip Mr. Gaidzik has spent most of his time in Buenos Aires, Montevideo, Sao Paulo, Rio de Janeiro, Bahia, Pernambuco, and the two Amazon cities, Para and Manaos. Speaking of the present possibilities of automobiles in the Amazon valley, Mr. Gaidzik does not look for a big future of either of the cities of Para or Manaos. From 5 to 10 years and perhaps more may be necessary to get the road-building movement started. Para, near the mouth of the Amazon, is a city of 150,000 with 200 automobiles. Of these seventy-five are privately owned vehicles, and the remainder are in taxi service. Motor trucks have made little progress in this city, there being only five trucks most of which are used in the brewery industry. To these must be added delivery wagons used by the large stores, which are not very numerous.

As in the majority of South American cities, the streets of Para are well paved with stone block, a good surface for motor use. The trolley tracks are, however, used almost exclusively. Cars for this city should have right-hand steering, although left-hand will do. The rules of the road in Para are the same as in the U. S. A. The 56-in. tread is satisfactory.

Manaos a Rubber City

Once the streets of Para are left there are no roads with the exception of dirt trails in the immediate outskirts of the city. The country is fairly level but generally covered with forest. There being little cultivation surrounding the city there is naturally no market for cars outside of the city limits.

The city of Manaos, like Para, is essentially a rubber city, but located well up the Amazon. With a population of over 100,000 there are about 100 automobiles in the city, a quarter of which are in use. To these must be added three or four motor trucks in the service of breweries and ice companies. You can use an automobile on the streets of the city and on the outskirts but once you are beyond these, the forest begins and all use of a car ends. The city streets in Manaos are paved with stone blocks as in Para.

In both of these rubber cities of the Amazon, the odor of crude rubber is omnipresent. There is a constant teaming of it in the city from dock to warehouse. Both cities are well provided with hotel accommodations. In Para there is a five-story hotel which ranks with any in South America. It is being added to at the present time. The hotel accommodations at Manaos, while not so extensive, are quite satisfactory.

The population in both of these rubber cities is largely Portuguese. There is a good sprinkling of English. All of the poorer classes are black.

Automobile imports in these Amazon River cities, according to figures from the Brazilian government, are as follows:

Port	1910	1911	1912	1913	1914	1915
Manaos	32	31	29	24	5	0
Para	72	76	61	58	14	0

Security Co. to Finance Dealers

ST. PAUL, MINN., Nov. 2—The Security Mortgage Co., this city, has been formed with a capital of $1,000,000 to finance automobile and truck sales here. It has taken headquarters in the New York Life Building and will begin business at once. G. N. Michaud will be in charge of the office.

J. N. Storr, president of Kuhles & Stock Co. is president; A. Hirschman, vice-president of the People's Bank, is vice-president; N. P. Rogers of Rogers & Rogers, live stock dealers, is treasurer and G. N. Michaud, secretary and general manager.

Two New Jeffery Sedans

KENOSHA, WIS., Nov. 6—The Nash Motors Co., this city, has brought out two new Jeffery sedans in four- and six-cylinder seven-passenger types, the tops being removable for summer touring. The large French plate windows drop 5 in. for ventilation in warm weather, the rear window measuring 19½ by 31 in. Divided front seats eliminate the necessity of fore doors and thus do away with the need for a panel between the front window and the rear door. Upholstery is gray whipcord and there are roll curtains on the windows.

Cassidy Handling Corning Conaphore

NEW YORK CITY, Nov. 6—The Corning Glass Works, Corning, N. Y., has appointed the Edward A. Cassidy Co. as sales division for the Corning Conaphore, a new device for giving the right direction and long range to automobile headlights, and for eliminating glare. It is made in white glass and patented Noviol yellow tint glass, which eliminates the violet-blue rays, enabling the light to penetrate fog and dust and does away with back glare.

Canadian Farmers Prosperous

High Price of Wheat Stimulates Sale of Automobiles to Rural Population

TORONTO, ONT., Nov. 3—Using the wheat quotations of the week as a barometer, the automobile manufacturers who sell machines to the farmers of western Canada find the outlook most gratifying. December wheat was quoted at $1.90 last week, nearly twice the figure of some seasons. Canada's war crop of wheat is yielding handsome profits to the farmers, which leads W. P. Hinton, traffic manager of the Grand Trunk Pacific Railway, to measure prosperity in terms of automobiles owned, and cars bought, in the present year.

"Farmers are exceedingly prosperous," he states, "and their purchasing power was never so great."

"Perhaps a striking illustration of this fact," declares the railroad man, "is that approximately $2,000,000 more than in any other year has been expended by the rural population in the purchase of automobiles. In fact, the automobile seems to have become a farm necessity, and even if we are disposed to consider it an extravagance, it certainly adds to the joy of living in the agricultural districts of Canada."

Racine Tire Branch Managers Meet

RACINE, WIS., Nov. 4—The Racine Auto Tire Co., this city, which already has announced plans for a new plant involving $100,000 or more, entertained its branch managers and salesmen at a convention at the present factory for two days last week. The policies of the company and plans for the disposition of the 1917 output were discussed. Managers of the branches at Chicago, Milwaukee. Minneapolis and Des Moines were present.

Selden Division Managers in Conference

ROCHESTER, N. Y., Nov. 6—The first conference of division sales managers and prospective division managers of the Selden Truck Sales Co., this city, under the regime of Sales Director H. T. Boulden, was held Nov. 2, 3 and 4.

Mr. Boulden presided, being assisted by President Geo. C. Gordon, Vice-President Wm. C. Barry, Jr., and Secretary R. H. Salmons.

Representatives in attendance were George S. Holvey, home office sales department; E. W. Templin, Chas. N. Gillette, Southeastern representative; Chas. E. Collard, Atlantic Coast representative; Wm. C. Barry, Jr., general manager, Selden Motor Vehicle Co.; Edward F. Drew, Middle West representative; Paul B. Donaldson, Northwest representative; W. E. Dugan, factory manager; H. T. Boulden, sales director; J. E. Morse, New England representative; C. L. Du Puy, Southwestern representative; S. P. Gould, Rochester, and D. S. Everett, Pacific Coast representative.

Anderson Sales Gain 141 Per Cent

Car Shipments for 4 Months Increase 79 Per Cent Over 1915 Period

DETROIT, Nov. 4.—The Anderson Electric Car Co. had an increase in business amounting to 141 per cent during its fiscal year. Car shipments for 4 months of the current year have been 79 per cent greater than for a similar period in 1915, and it is expected that the company's business for the current year will be 100 per cent greater than last year. Directors elected are: W. C. Anderson, M. S. Towson, J. B. Book, Jr., G. M. Bacon, G. D. Fairgrieve, W. M. Locke, W. P. McFarlane, W. H. Murphy, F. E. Price. The directors elected officers as follows: W. C. Anderson, president; M. S. Towson, vice-president; G. D. Fairgrieve, vice-president and assistant treasurer; W. P. McFarlane, secretary and factory manager; W. M. Locke, treasurer; F. E. Price, assistant treasurer; Wilson Oritzer, assistant secretary.

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Studebaker Earns $8,140,420

DETROIT, Nov. 3.—The Studebaker Corp. reports net profits for the 9 months ending Sept. 30 amounting to $8,140,420. The net profits for the same period in 1915 were $7,082,479.

Practically all of the net profits this year were from domestic business, as total net profits from war orders were $154,000, as compared with $3,140,000 realized on war orders last year.

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70 Per Cent of Gasoline Pumps Tested Found Inaccurate

WASHINGTON, D. C., Nov. 6—The Bureau of Standards has in circulation report No. 81 on liquid measuring-pumps for selling gasoline. The report, in addition to a description of the different systems, gives results of some inspections having to do with the accuracy of these pumps.

Of seventy-nine measuring systems of various types chosen at random and tested in a number of different cities, fifty-five, or 70 per cent, had errors in excess of the tolerance allowable, and twenty-four, or 30 per cent, had errors within the tolerance. In addition, there were eight outfits so constructed as to be absolutely unsuited for retail liquid dispensing.

Of the fifty-five out of tolerance 80 per cent gave deliveries in deficiency and 20 per cent in excess. This tendency toward deficient measurement is worthy of careful consideration, and it is only proper to call attention to the fact that most of the causes of error in measuring-pump operation tend toward the side of deficient delivery. Among these may be mentioned leaks, retention of liquid by the hose. excessive virtual suction head, resulting in vaporization and other losses, failure to complete the full stroke and slippage.

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Templars Motors Corp. Formed

CLEVELAND, Nov. 3.—The Templars Motors Corp. has been formed, and will manufacture a four-passenger roadster at $1,250, a five-passenger touring car at $1,250, a five-passenger sedan at $1,850, and a two-passenger roadster at $1,225.

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Materials Markets Steady

NEW YORK CITY, Nov. 8—The automobile materials' market was steady last week, very few price changes taking place. Steel, copper, aluminum, and lead, remained constant. Ceylon rubber was 3 cents higher per pound, reaching 60. Tin rose to $42.33 1/3 per 100 lb., a net rise of 45 cents. Cottonseed oil declined 60 cents per barrel to $11.80. The rest of the materials were unchanged and steady, as shown in the accompanying tabulation.

It is estimated that 80 per cent of the copper production for the first 6 months of 1917 has been sold, indicating that approximately 900,000,000 lb. of copper have been placed on the producers' books for delivery during the period from Jan. 1 to June 30 next.

Daily Market Reports for the Past Week

Material	Tues.	Wed.	Thur.	Fri.	Sat.	Week's Ch'ge.
Aluminum, lb.	.65	.65	.65	.65	.65	...
Antimony, lb.	.13	.13	.13	.13	.13	...
Beams and Channels, 100 lb.	2.96	2.96	2.96	2.96	2.96	...
Bessemer Steel, ton	50.00	50.00	50.00	50.00	50.00	...
Copper, Elec., lb.	.28½	.28½	.28½	.28½	.28½	...
Copper, Lake, lb.	.28½	.28½	.28½	.28½	.28½	...
Cottonseed Oil, bbl.	12.40	12.35	12.22	12.10	11.80	— .60
Fish Oil, Manhaden, Brown, gal.	.60	.60	.60	.60	.60	...
Gasoline, Auto, bbl.	.22	.22	.22	.22	.22	...
Lard Oil, prime, gal.	1.25	1.25	1.25	1.25	1.25	...
Lead, 100 lb.	7.02½	7.02½	7.02½	7.02½	7.02½	...
Linseed Oil, gal.	.90	.90	.90	.90	.90	...
Open-Hearth Steel, ton	50.00	50.00	50.00	50.00	50.00	...
Petroleum, bbl., Kans., crude	.90	.90	.90	.90	.90	...
Petroleum, bbl., Pa., crude	2.60	2.60	2.60	2.60	2.60	...
Rapeseed Oil, refined, gal.	.95	.95	.95	.95	.95	...
Rubber, Fine Up-River, Para, lb.	.83	.83	.83	.83	.83	...
Rubber, Ceylon, First Latex, lb.	.57	.57	.58	.58½	.60	+ .03
Sulphuric Acid, 60 Baume, gal.	1.50	1.50	1.50	1.50	1.50	...
Tin, 100 lb.	41.87½	41.75	41.75	42.12½	42.33⅓	+ .45
Tire Scrap, gal.	.06⅜	.06⅜	.06⅜	.06⅜	.06⅜	...

Security Prices Are Higher

Tire Issues Strong—Much Buying on Margin—Further Rise Expected

NEW YORK CITY, Nov. 8—The usual heavy buying and selling before Election Day occurred on Monday. The market was mostly bullish, the majority of buyers predicting a rise after Election Day. As a result of this heavy buying prices of many issues rose. Much pressure was brought to bear on Ajax Rubber and United Motors, which went up 3⅞ and 2 points, respectively. General Motors, Chalmers, Firestone and Kelly-Springfield Tire, were also in demand.

General Motors common rose 10 points as did Chalmers. Chalmers preferred rose 7 points, one of the features of the week. This company announced a refinancing plan last week. Firestone Tire common rose 5 points to 1150, a record price. Kelly-Springfield Tire common rose 2½ points to 77½.

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Hayes Wheel Co. Add $500,000

JACKSON, MICH., Nov. 6—The Haynes Wheel Co., this city, has increased its capitalization from $1,000,000 to $1,500,000. The increased fund will be used for additional machinery and equipment for the manufacture of wire wheels.

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Newell Purchasing Agent for Hood

DETROIT, MICH., Nov. 3—R. B. Newell has joined the staff of the Wallace Hood Service Bureau as the purchasing agent. Mr. Newell was formerly connected with the Briggs Detroiter Co. as service manager.

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Bate Predicts Higher Material Prices

DALLAS, TEX., Nov. 6—That automobile makers of the North and East are expecting an advance in materials that may result in higher cost of automobiles, was the statement expressed by John W. Bate, vice-president and chief engineer of the Mitchell Motors Co., in an address before Texas Mitchell dealers at Dallas last week. The address was given at a dinner tendered by H. T. Hays, district representative for the Mitchell company at the Adolphus Hotel. Other factory representatives who spoke at the meeting were: George W. Hipple, general merchandising counsel and F. W. Pelton, advertising manager.

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Avery Tractor Maker's Capital $2,300,000

LOUISVILLE, KY., Nov. 3—B. F. Avery & Sons, manufacturers of gasoline trac-

tors in this city, have filed amended articles of incorporation fixing the capital stock at $2,300,000, against the old capitalization of $1,500,000. The $200,000 of 7 per cent series A preferred will be retired and a series known as A1 preferred, consisting of 7000 shares at $100, bearing 7 per cent, will be issued; another series of $600,000 preferred, paying 6 per cent, will be put out. There is a similar issue outstanding. There will be 10,000 shares of common of $100 each, as compared with 700,000 authorized at present.

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S. R. B. Earnings Halt Reorganization

PHILADELPHIA, PA., Nov. 3—The earnings of the Standard Roller Bearing Co. during the past year have shown so much improvement that the proposed reorganization of the company, it is stated, has been practically abandoned. Net earnings for the year ended Sept. 30 last were $747,546.

There are outstanding $2,725,850 common, $572,750 7 per cent cumulative preferred of authorized issues of $4.000,000 common, $3,000,000 first preferred and $1,000,000 second preferred stock.

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Fisk Ratifies Increase of Capital

CHICOPEE FALLS, MASS., Nov. 1—The Fisk Rubber Co., this city, has approved the increase in capital from $19,400,000 to $39,500,000 and extension of time for conversion of second preferred to common stock from Nov. 1, 1917 to Nov. 1, 1932.

Packard Continues Expansion

Many New Buildings—Numerous Machines Installed —Sociological Work

DETROIT, MICH., Oct. 27—Fourteen months ago the Packard Motor Car Co. ordered a bird's-eye view made of its plant. When it was finished it was found to be old compared with the number of buildings added after the photograph was taken. The company has endeavored three times since to secure a bird's-eye view, but always with the same result. The building construction has been so rapid and vast that each view is always one or two stories or buildings behind. It is quite likely that the view shown here, though finished as the story is written, will not include the structures that have been started or completed in the past few days. Demands for increased productive facilities have been so urgent that construction of new buildings cannot catch up with it.

During the past year, 6.6 acres of floorspace have been completed while 4 acres are under course of construction, making a total space of 58.2 acres of floorspace that the company will utilize for the manufacture of its products. The buildings completed recently cost $1,000,000 and those in the course of erection amount to $350,000. The company will have a total of sixty-six buildings when all plans for immediate construction are finished. Those recently completed and under course of construction include a traffic garage, 54.9 by 183 ft., two six-story additions to the stock room building, each 103 by 200 ft., a power house addition four stories high, 65 by 140 ft., two four-story additions, each 60 by 396 ft., a lumber storage shed 50 by 140 ft., a truck storage building, 36 by 272 ft., and a heat treating plant four stories high and 60 by 130 ft. There will be a total of 2,553,272 sq. ft. of floorspace when all structures in course of erection are completed, divided into four divisions: main division, 1,792,061 sq. ft., service division, 216,087 sq. ft., truck division, 346,292 sq. ft., and the forge and foundry division which serves both trucks and pleasure cars and will have 198,380 sq. ft.

5530 Major Machines

There are 5530 pieces of major machinery in the factory of which 550 were recently installed including the following among the more important:

Toledo press, cost $8,000, which has a pressure capacity of 250 tons and is used to stamp sheet metal into running boards, bonnet sides, fenders, etc., and which is almost as large as one side of the building it occupies.

A flywheel machine that performs all finishing operations on the raw flywheel casting in 11 min.

Two worm bevel gear wheels and worm bevel pinion cutters that cut to 0.001 in., and which cost $3,000 each.

A milling machine, cost $6,275, that mills the rough off the cylinder blocks

Automobile Securities Quotations on the New York and Detroit Exchanges

	Bid	Asked	Week's Ch'ge
Ajax Rubber Co.	70	73	+3⅜
J. I. Case T. M. Co. pfd.	83	85	—3
Chalmers Motor Co. com.	125	140	+10
Chalmers Motor Co. pfd.	105	115	+7
*Chandler Motor Car Co.	105	105½	+1
Chevrolet Motor Co.	186	190	..
Fisher Body Corp.	39	42	+1
Fisk Rubber Co. com.	..	93	..
Fisk Rubber Co. 1st pfd.	109	113	+1
Fisk Rubber Co. 2d pfd.	95	105	—5
Firestone Tire & Rubber Co. com.	1150	1170	+5
Firestone Tire & Rubber Co. pfd.	104	106	—6
*General Motors Co. com.	810	875	+10
*General Motors Co. pfd.	124	126	—2
*B. F. Goodrich Co. com.	71⅜	71⅝	—1⅛
*B. F. Goodrich Co. pfd.	112	114	..
Goodyear Tire & Rubber Co. com.	293	296	—3
Goodyear Tire Rubber Co. pfd.	108¾	109½	+ ¼
Grant Motor Car Corp.	8	10	..
Hupp Motor Car Corp. com.	5¼	6	..
Hupp Motor Car Corp. pfd.	92	100	..
International Motor Co. com.	4	8	—1
International Motor Co. pfd.	20	30	..
*Kelly-Springfield Tire Co. com.	77½	78	+2½
*Kelly-Springfield Tire Co. 1st pfd.	97	100	..
*Lee Rubber & Tire Corp.	41½	41½	+1
*Maxwell Motor Co. com.	84½	84⅞	—1
*Maxwell Motor Co. 1st pfd.	85	86	— ½
*Maxwell Motor Co. 2d pfd.	54	54½	—1
Miller Rubber Co. com.	240	260	..
Miller Rubber Co. pfd.	105	107	..
Packard Motor Car Co. com.	..	175	..
Packard Motor Car Co. pfd.	93	99	—1
Paige-Detroit Motor Car Co.	38	39	—4
Peerless Truck & Motor Corp.	23	25	+1
Portage Rubber Co. com.	170	173	..
Portage Rubber Co. pfd.	170	173	..
Regal Motor Car Co. pfd.	20	30	+3
†Reo Motor Car Co.	46	48	..
Saxon Motor Car Corp.	77	79	— ½
Springfield Body Corp. com.	95	100	..
Springfield Body Corp. pfd.	120	130	..
Standard Motor Construction Co.	7	9	— ½
Stewart Warner Speed. Corp. com.	110½	112½	—1
Stewart Warner Speed. Corp. pfd.	..	..	..
*Studebaker Corp. com.	128⅛	129	+1¼
*Studebaker Corp. pfd.	111½	112	+1
Swinehart Tire & Rubber Co.	90	92	..
United Motors Corp.	64½	64¾	+2
*U. S. Rubber Co. com.	60¾	61⅛	+1¾
*U. S. Rubber Co. pfd.	110	111	..
White Motor Co.	55¼	56	+1¼
*Willys-Overland Co. com.	42½	42¾	+ ¼
*Willys-Overland Co. pfd.	103	104	+ ½

*At close Nov. 4, 1916; listed New York Stock Exchange. †Par value $10; others $100.

Quotations by John Burnham & Co.

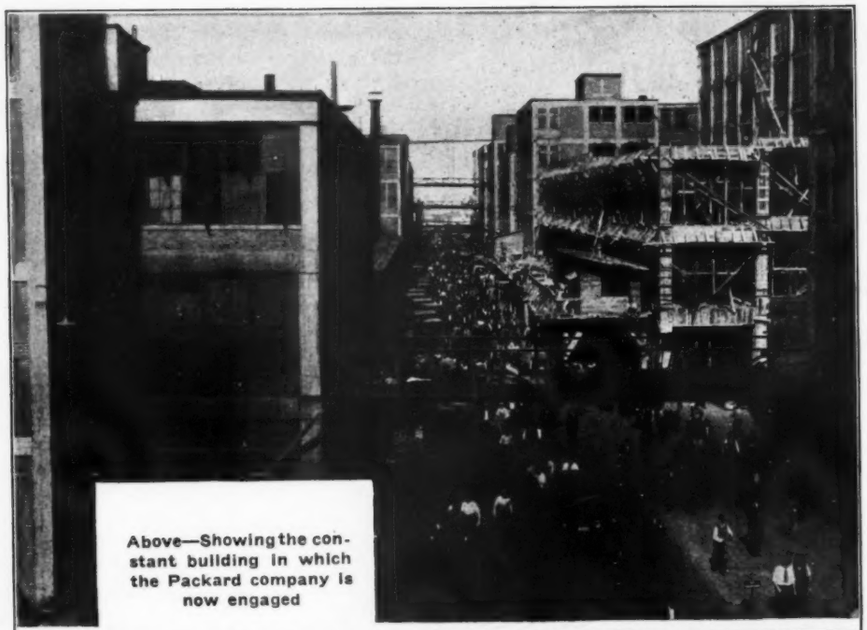
OFFICIAL QUOTATIONS OF THE DETROIT STOCK EXCHANGE

ACTIVE STOCKS

	Bid	Asked	Net Ch'ge
Auto Body Co.	42½	44½	— ¾
Chalmers Motor Co. com.	124	130	+4
Chalmers Motor Co. pfd.	..	..	..
Continental Motor Co. com.	37½	38½	— ¾
Continental Motor Co. pfd.	9½	10¼	..
Ford Motor Co. of Canada	..	300	..
General Motors Co. com.	790	850	—10
General Motors Co. pfd.	124	127	— ½
Maxwell Motor Co. com.	83½	86	—3½
Maxwell Motor Co. 1st pfd.	84	86½	—1½
Maxwell Motor Co. 2nd pfd.	52½	55½	—1¼
Packard Motor Car Co. com.	..	170	..
Packard Motor Car Co. pfd.	100	102	..
Paige-Detroit Motor Car Co.	38	40	—3
W. K. Prudden Co.	49¼	50½	+ ¼
Reo Motor Car Co.	45½	46¾	— ½
Studebaker Corp. com.	126½	129½	—5½
Studebaker Corp. pfd.	109	..	..
C. M. Hall Lamp Co.	..	31	..

INACTIVE STOCKS

Atlas Drop Forge Co.	..	33	..
Kelsey Wheel Co.	55	60	..
Regal Motor Car Co. pfd.	20	..	+2



Above—Showing the constant building in which the Packard company is now engaged

Below—Overhead trolley system used in the progressive assembly plant of the Packard company

Two of the recent additions used for progressive assembly work

and reams it in consecutive operations in 6.7 min.

Two smaller milling machines of the same nature as the one above.

A cylinder boring machine that bores out rough cylinder blocks, and mills it by a progressive revolving operation.

Eight multiple drills costing $3,000 each and capable of drilling 156 different holes in the crankcase and cylinder blocks in 28 min.

One multiple drill that bores forty-seven holes in the transmission case in one operation.

Two hydraulic presses that force the rear axle housing onto the tube and have a pressure of 20 tons to the square inch. Each of these machines takes a floor-space 10 by 30 ft.

Two special Packard machines that dome the inside of cylinder blocks and which were designed, invented and built in the Packard factory.

Progressive Assembly

The plant operates upon the progressive assembly and manufacturing system based upon six divisions arranged as:

(*a*) Progressive machinery.
(*b*) Progressive stock conveying.
(*c*) Progressive chassis erection.
(*d*) Progressive motor assembly.
(*e*) Progressive enameling.
(*f*) Progressive final assembly.

The stock conveying mechanism was recently finished for the assembly of rear axles and transmissions at a cost of $35,000.

The final assembly is conducted in one of the new buildings that parallels the stockrooms and is so situated that the bins can be loaded with fifty car lots of various stocks at one time and the workers are never forced to move more than 7 ft. from the stock supply. Both floor and overhead trolley conveyors are in use. The bodies are lowered on to the chassis by means of the overhead system.

New ovens, 126 ft. long, have been installed in the enameling rooms and are capable of 400 to 500 deg. of heat. Two huge tanks holding 1860 gal. are utilized to clarify the enamel and a mechanical washing machine was recently added that contains 250 bbl. of water and is used to secure and cleanse all parts before they are enameled.

12,000 Employees

The company employs 12,000 men and plans to use 15,000 when the buildings now being erected are completed. It does much for its employees to uplift them in their homes, business and social life and has commenced several schools besides erecting a clubhouse and baseball ground.

The school includes courses for salesmen, truck manufacture and motor work, and also the teaching of English to foreigners.

Guaranty Securities Corp. To Finance Truck Sales

(*Continued from page 789*)

There are two charges, Charge A and Charge B. Charge A applies to all trucks below $1,500 and Charge B must be applied to all above $1,500. Charge B may be applied to those below $1,500. Charge B is the addition of a flat $30.50 to Charge A to cover collision insurance, and in case the service is such that collision is at all probable the dealer may insist upon the buyer paying Charge B where Charge A might otherwise prevail.

Above $1,500 the Charge B is 5 per cent of the delivered price.

These two charges are made because the collision risk is considered greater on the heavier trucks. Rather than base the charge on weights it was deemed more satisfactory to base the dividing line on price, the corporation believing that $1,500 is a good mark between heavy and lighter vehicles.

In case trucks are going into such a rush-and-hurry service as mail delivery, and if the price is below $1,500, the collision risk is greater, and in that case Charge B would apply below $1,500.

Charge A, as does Charge B, includes the usual fire and theft insurance and covers the cost of handling the deal. The insurance becomes effective as soon as the contract is signed and the truck delivered.

The dealer determines whether Charge A or B is to be made.

In case the dealer takes a car or truck in trade the allowance made must be included in the 25 per cent cash payment that he secures when the new truck is delivered. The Guaranty corporation will not finance the sale of used trucks.

If a buyer wishes he may pay more than 25 per cent down and may make the term of payment less than one year—but not more. Dealers are encouraged to get as much down as possible and as short a payment term as possible.

The interest on the notes and the Deferred Certificate must not exceed the prevailing legal rate. In most States this is 6 per cent, wherefore 6 per cent has been used in the table at the beginning of this story.

After the dealer has secured the 25 per cent cash payment he enters into a conditional sale contract with the buyer. This form is laid out in a very simple way. Under each blank space to be filled in is a small number. On the first page of the contract is told what these numbers mean, so that the dealer may always know just how to make out the contract. For instance, under one blank space it says "7." The first page of the contract says: "7, the amount of the note." So, where it says "7" the dealer writes in the amount of the note.

Handling the note is made simple. The note is attached to the first page of the contract. All the dealer has to do is fill in the blank space as explained by the numbers, there even being directions as to where the buyer's name shall go. It is difficult for a dealer to go wrong in filling out this contract and note.

Having the contract and note signed, the dealer forwards them to the Guaranty Securities Corp. and in a few days receives 90 per cent of the face of the note in cash. He then has 25 per cent of the whole and 90 per cent of the 75 per cent balance, which amounts to 92½ per cent of the whole price of the truck, including freight.

For the remaining 7½ per cent the dealer has to wait until the buyer makes the last payment, but this is represented by a Deferred Certificate, upon which he receives interest at the same rate the note itself carries.

The dealer has nothing whatever to do with making collections, and the buyer deals only with the securities corporation. Local banks are not involved.

One other little job the dealer has to do is have the buyer fill out a Purchaser's Statement. Statement A is used in case the buyer is worth more than $5,000 and Statement B if he is worth less.

Matters are still further simplified for the dealer by the attachment to the contracts, which are in duplicate, of a printed letter form. This is filled out by the dealer and mailed with the note and contract to the Guaranty corporation.

Advantages to the dealer are: He can

Extend his business without increasing his capital.

Secure sales where cash-buying might stand in the way.

Get all his cost and nearly all his profit at the time of sale.

The buyer:

Gets his truck at once and pays for it while he is using it.

Does not have to have credit handled through local bank.

Notes are held in trust, not hawked about.

THE DEALER'S PART.

1—Collects 25 per cent of $1,312 in cash, which includes the $67.50 that goes to the Guaranty Securities Corporation	$328.00
2—Sends to Guaranty Securities Corporation note for the balance of 75 per cent	984.00
3—Receives at once 90 per cent of face of note, deducting $67.50, which was received by dealer for Guaranty Securities Corporation's charge	818.10
4—Dealer has received in cash at once	$1,146.10
5—Receives Deferred Certificate for 10 per cent of $984, bearing interest at 6 per cent...$98.40	
6—When last payment is made he gets the $98.40	98.40
List price of truck plus freight	$1,244.50
7—Dealer also receives 6 per cent interest on the $98.40 Deferred Certificate	5.90
Dealer actually receives for truck	$1,250.40

THE BUYER'S PART.

1—Pays cash 25 per cent of $1,312	$328.00
2—Signs conditional sale contract and note for balance of ...$984.00	
3—Pays $82 monthly for 1 year	984.00
Delivered price of truck	$1,312.00
4—Also pays interest on the note	31.98
Buyer actually pays for truck	$1,343.98
Price of truck plus freight	1,244.50
Cost of accommodation	99.48
Cost of accommodation per month	8.29
" " " per week	1.91
" " " per day	.33

GUARANTY SECURITIES CORPORATION'S PART.

1—Accepts from dealer the buyer's note for	$984.00
2—Advances to dealer at once 90 per cent of $984 minus the $67.50 Guaranty charge	818.10
3—Collects $984 from buyer in 12 monthly payments.	
4—When last payment is collected pays dealer Deferred Certificate of $98.40, plus interest at 6 per cent.	104.30
5—Company realizes as follows:	
a—Guaranty charge	$67.50
b—Interest from buyer	31.98
Total	$99.48

Guaranty Plan for Selling Trucks on Time

Illustrating by a truck listing at $1,200 and on which the freight is $44.50. The interest rate is assumed to be 6%. The plan is based upon the Delivered Price, which is arrived at as follows:

Factory list price, f.o.b., chassis and body	$1200.00
Freight	*44.50*
Price the dealer must get for himself	1244.50
Guaranty Securities Corporation's charge	*67.50*
CUSTOMER'S DELIVERED PRICE. What the buyer must pay	1312.00

CHARGE A

May apply up to $1.500 Job. Includes incidentals and usual fire and theft insurance for one full year.

CHARGE B

May apply up to $1,500 Job—Required on trucks selling for more than $1,500. Includes incidentals and usual fire, theft and collision insurance for one full year.

GUARANTY CHARGES

$14.50	On all trucks between	$500	and less	$45.00
22.00	" " "	501	"	$750	52.50
29.50	" " "	751	"	1,000	60.00
37.00	" " "	1,001	"	1,250	67.50
44.50	" " "	1,251	"	1,500	75.00
Must pay CHARGE B on all trucks		1,501 or more		5% of delivered price

The Automobile

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Horace M. Swetland, President
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A. B. Swetland, General Manager
T. B. Van Alstyne, Advertising Manager
231-241 West 39th Street, New York City

EDITORIAL
David Beecroft, Directing Editor
Donald McLeod Lay A. Ludlow Clayden Sydney Oxberry
J. Edward Schipper, Special Representative, Detroit

BRANCH OFFICES
Chicago—Mallers Bldg., 59 East Madison St., Phone Randolph 6960
Detroit—95 Fort Street, West, Phone Main 1351
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Cable Address ---------- Autoland, New York
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Engine Development

POWER plant improvement is a major development in the industry. Every demand made upon the car is reflected in the engine. The automobile-buying public has been educated to the point where the engine demands are in excess of what the nature of the fuel would suggest as being feasible, and the matter has developed itself into a contest between the possibilities of the fuel and of superdevelopment in the methods of vaporizing it and burning it.

The path for future progress is fairly clear. There is little doubt regarding the way in which design must travel if it is to continue to progress. Better vaporization of the heavier fuel, increased volumetric efficiency, or in a word, the increase of mean effective pressures by improvements in design which will tend to get the gas into the cylinder in a condition best suited for rapid combustion and with the least possible friction due to restrictions and bends in the ports.

Lighter reciprocating parts are a necessary development due to other improvements which have permitted higher speeds. With the power plants of a few years ago where the maximum piston speed was 1000 ft. per min. for passenger vehicles, it was not necessary to be so very careful regarding reciprocating weights and balanced crankshafts.

With many manufacturers recommending a piston speed of 2000 ft. per min. for passenger cars, these things become necessary. Furthermore, the gas speeds have increased, and it is necessary that ports be smoother, that the fuel be better vaporized (even though it is heavier), and that the volume of the cylinder is better filled at each stroke.

The small high-efficiency power plant is surely going to increase. To-day there are engines on the drafting boards which should be capable of maintaining 3000 r.p.m. steadily and without vibration of over-stressing of the parts. The high-speed engine provides the answer to the 4-to-50-mile-an-hour flexibility, and it is along these lines that the development of the next 2 years is likely to occur.

Detachable Heads

ENGINES with detachable heads are on the increase and have proved successful with very few exceptions. There are certain precautions to be observed in the design which when followed give a unit that is accessible and easily taken care of.

Where the detachable head has failed it is generally because insufficient water was carried into the head because of improper passages leading from the cylinder casting to the head casting. If these passages are arranged correctly there will be no difficulty in getting the water around the head.

It will be impossible to use anything but a good quality copper-asbestos gasket between the cylinder and the head. If a plain paper gasket is used there will be trouble as soon as a renewal is attempted and a leakage will occur. The copper-asbestos gasket is more expensive, but that expense is justified, and seems necessary.

The benefits to be gained from the removable head are many both from a manufacturing and maintenance standpoint: They are an aid to accurate cylinder grinding and are valuable in that they assist the manufacturer to maintain a very narrow limit of variation on combustion chamber size. To the user they are a great boon when it comes to cleaning out the cylinders, removing carbon or in grinding valves.

The Tractor Engine

ENGINES for tractors must be able to battle successfully with the dust cloud. There are two ways of doing it: First by keeping everything tightly closed so the dust cannot enter and second by making the parts of such materials that they are not damaged by dust. The designer of a tractor motor must do both.

The two important entry points for dust are the breather and the carbureter. A washing arrangement for the carbureter air will prevent the grit from entering. On the breather there is plenty of room for ingenuity to keep the dust out and each manufacturer has a pet method of his own.

In the way of materials, the parts must be hard so that the little diamond-like grains will not cut them, and furthermore, they must be large and stiff to withstand the racking stresses of a tractor.

Engines for 1917 a Culmination of Refinement

Few New Designs But Great Improvements in Detail Result in Higher Thermal and Mechanical Efficiencies—Longer Life and More Economical Manufacture Part of Year's Progress

Part I—The Trends in General

By J. Edward Schipper

THERMALLY, mechanically and economically, the American gasoline engine has received a great forward impulse during 1916. If all the progress made by our individual master builders could be concentrated into a single engine, that power plant would give back more power and useful work from a given quantity of fuel, more energy for a given size, travel farther on a gallon, be less expensive to manufacture, easier to maintain and have a longer life than the product of a year ago.

At this very moment we are in the midst of a period of engine development which makes almost certain the prediction that during the next 12 months a longer stride in the direction of perfection will be taken than the combined steps of the past decade. The latest products of our power plant specialists are capable of a performance as stock jobs that far surpasses the special engines of even 3 years back. And the most significant fact in connection with the development is that nowhere can be found a radical revision of design. What has been accomplished has been done by steady and patient digging into details.

Our engines for 1917 are more efficient thermally, principally because they are more efficient from a volumetric standpoint. The development of the high-speed engine has worked against the development of higher volumetric efficiencies and yet the improvements in detail of design have actually brought forth a net gain in that respect. It will be interesting to note, in going through this story of improvement, how minor changes in the valve action in some instances, the port design in others, and in some cases the rearrangement of very small details have added as much as 20 per cent more power to a power plant.

Mechanical Efficiency Increased

Mechanical efficiency has been increased largely through the carrying out of trends that were clearly expressed a year ago, and chief of these is the reduced weight of reciprocating parts. Next in order comes the balance of rotating masses, and third the better arrangement and individual design of the lubricating system insofar as the placing of the oil bath at points where it is most needed and in the proper quantity is concerned. Mechanical efficiency of an engine is the ratio of the brake to the indicated horsepower, expressed mathematically. It is a measure of the approach towards the ultimate in any given motor size, and when it is stated that the engine of 1917 has a better mechanical efficiency than its predecessor, it means that better performance is being secured from engines of equal displacement. Here again it will be highly interesting to note how the alterations in detail have brought about this important result.

Accessibility and Life

Coming to another broad highway of progress, that of longer life, it is found that the general methods for securing this have been in the reduction of stresses on parts through better design. Put in another way, it means higher factors of safety secured through better arrangement of parts, better materials, safer dimensions in a few instances and indirectly through a very important development in the way of accessibility. The two qualities of accessibility and life are bound very closely together.

The qualities demanded by the automobile buyer have forced this progress. A buyer of to-day demands a car that will have a speed range averaging from 4 to 50 m.p.h. on high gear. He demands a large power-to-weight ratio to give acceleration and hill-climbing ability and silence. Smoothness, economy and low price are among some of the other requirements that are made and insisted upon. To meet this demand with an engine that has for its working medium a fuel which is ever presenting greater difficulties in the way of vaporization, has taxed the ingenuity of the engineers as never before.

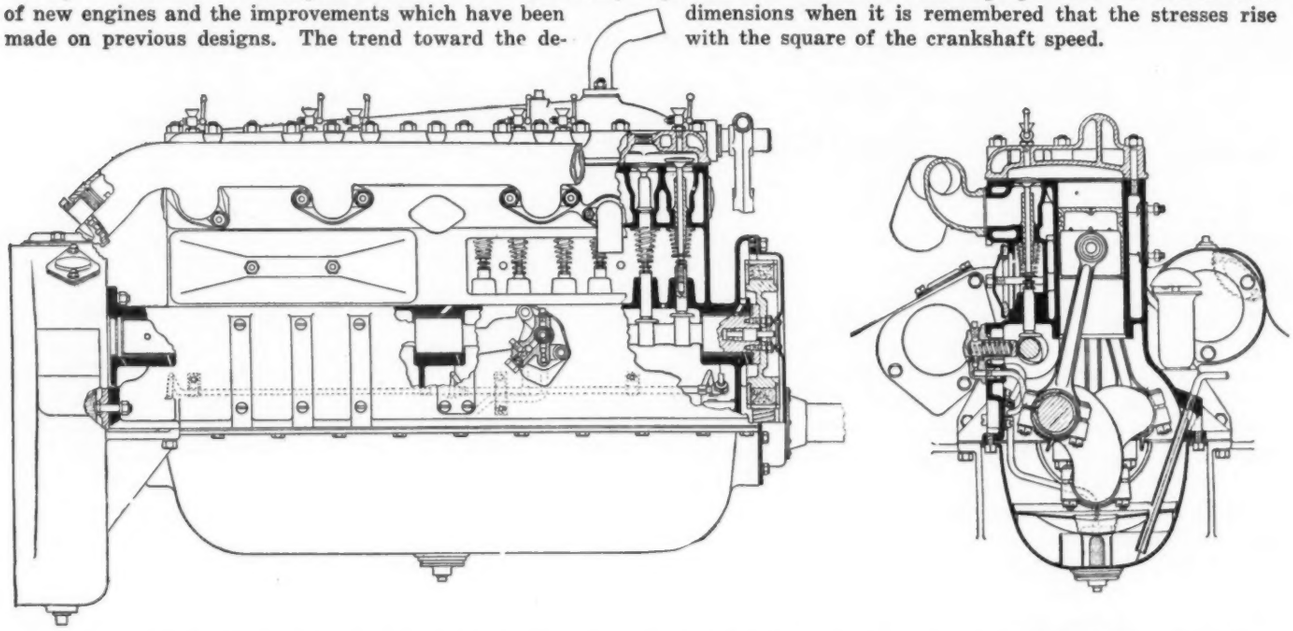
One of the greatest factors this year has been in the matter of material prices. Tungsten valves, aluminum pistons and cylinders, aluminum crankcases, alloy steel crankshafts and gears have been

particularly affected by the rises. One result is that no attempt has been made to go beyond experiments particularly in the direction of the aluminum motor, during this year.

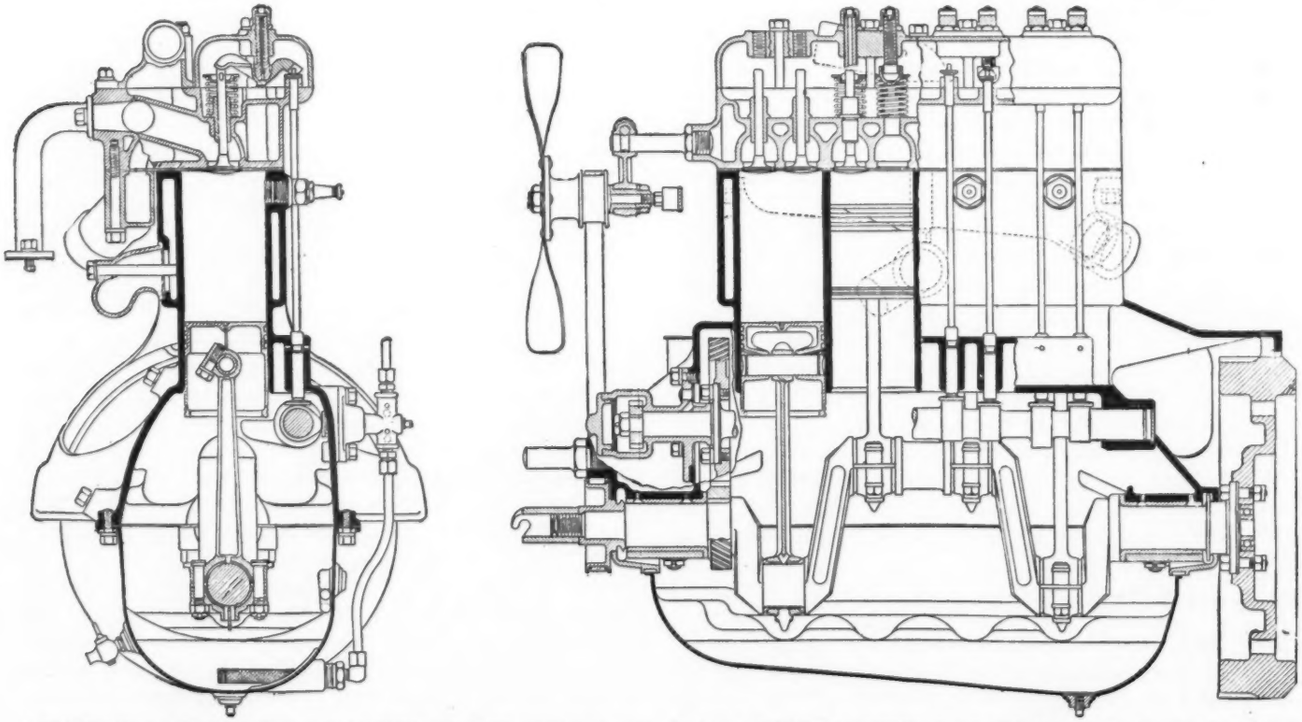
On the other hand, the improvement of machining and casting work has continued at about the same rate as in previous years and much of the credit belongs to these tool room designers who have enabled the motor manufacturer to produce economically and at a profit even in the face of the higher cost of materials.

In the general make-up of the engine, the trend toward the overhead valve seems to have struck its level, and there has been no falling off or increase during the year that is worthy of note. In fact the year is notable for the scarcity of new engines and the improvements which have been made on previous designs. The trend toward the detachable head continues. There has been one concern which has dropped the design, but others have added it so that the scale still shows a balance toward the detachable head.

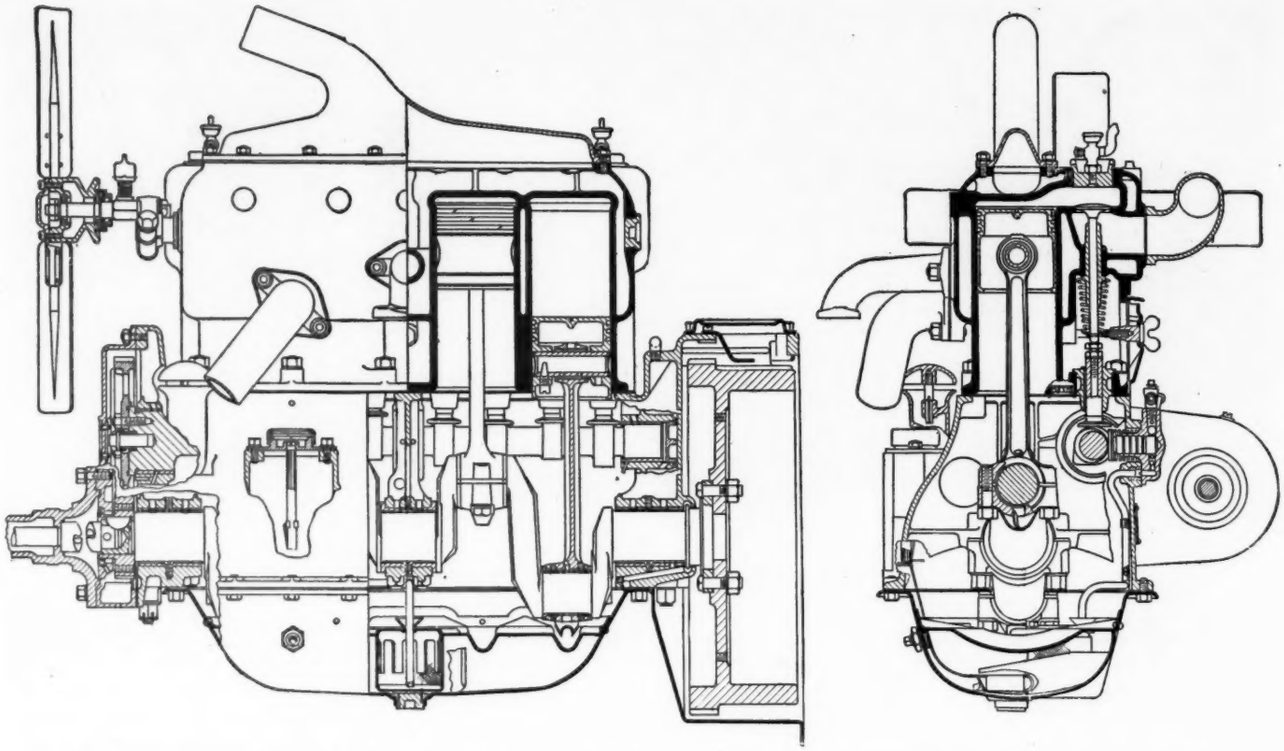
Crankshaft balance has been made more or less of a fad by the exploitation of some new designs through various sales mediums. As a matter of fact no new problems have been encountered by the engineer, beyond those which are natural with the higher speed of rotating and reciprocating parts. Piston speeds have been climbing up to the point where engine designers believe that the best practice for passenger car work is around 2000 ft. per minute piston speed. This is approaching quite close to 3000 r.p.m. and naturally the question of balance assumes proportions of considerable dimensions when it is remembered that the stresses rise with the square of the crankshaft speed.



L-head Continental engine with integrally-cast iron crankcase and detachable head. The end section at the right shows the moon-shaped throws on the crankshaft for balancing purposes. Crankshaft balance has received marked attention this season



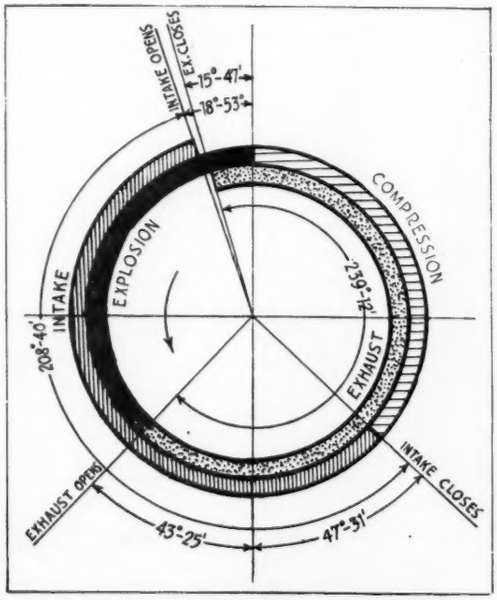
Sterling four-cylinder valve-in-head design for light passenger cars. It has a detachable cylinder head with the spark plugs in the side and the fan direct driven from the crankshaft acting as a vibration damper



Longitudinal and transverse sections through a typical Continental four-cylinder unit which can be successfully applied to trucks. The cylinders are cast in a single block, but the crankcase and oilpan are separate

The curved-cheek crankshaft is in the majority and instances of elaborate systems of counterweighting are practically unknown among the engine specialists. Perhaps the most interesting case of counterweighting is in an engine developed for gasoline-electric purposes by the Milwaukee Machine Tool Co., in which the counterweights are carried practically into the plane of rotation of the crank. The weights are brought as closely as possible to this vertical transverse plane while maintaining a pathway for the connecting-rod. This is a very small displacement engine, four-cylinder 2½ by 3½ in. designed to run continuously at close to 3000 r.p.m. and all parts are designed for such conditions.

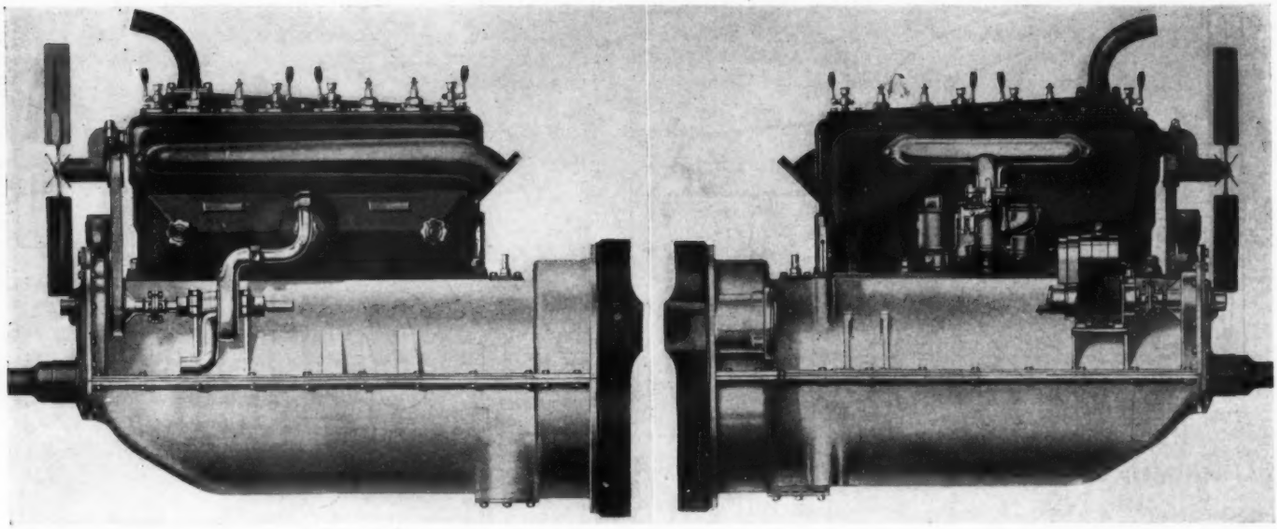
Another high-spot in gasoline engine development is in the provisions made to aid in the vaporization of the fuel. The day is past when the engine builder puts the entire question up to the carbureter maker. Almost every manufacturer of engines has devised some method of preheating the charge, and this in the face of the struggle for higher volumetric efficiencies. Yet it is a matter of necessity now. The day has arrived when the gasoline engine really can burn kerosene, and not a few of them are doing it. The tractor engine is the connecting link where kerosene and gasoline are both being used, and the cored-in intake manifold or the unit intake and exhaust manifold have become very prominent this year. The Waukesha motors have a very nicely worked-out double manifold and the Golden, Belknap and Swartz engine also has a new development in this respect. The Falls intake manifold is now incorporated in the removable head of the engine. These are good examples of what everyone is doing or has done on the newest models.



Valve-timing diagram of model 20 Sterling engine, looking at the front of the flywheel

Before going into the details of motor improvement it should be remarked that power plants are not, taking them as a grand average, lighter than last year because the use of aluminum has dropped off in crankcase work to some extent. They are more powerful for their weight, however, and this is really what counts as long as the weight is not excessive. Individual parts of the engine which promote efficiency through being light have been reduced in weight.

Aluminum pistons are still in the balance. Personal talks with practically every engineer in the motor manufacturing business still give the general impression that they have neither become accepted nor condemned for general practice. It is not so much a matter of price, although in the opinion of one engineer it costs $6 more per motor to use the aluminum with present prices. A year ago though, it seemed as if the aluminum piston would become the standard in all motors within a year. At the present time there is no doubt but that the opinion of the majority of the engineers is that the real lightweight piston has not as yet been developed. On the other hand, it does not lack its firm supporters, so the matter is still on the fence with experimenting actively being carried on all over the country. One interesting fact is worthy of comment and that is, the aluminum piston has found greater favor among the automobile engineers than among the motor manufacturers who build for the trade. Where the aluminum piston has fallen



Both sides of the Wisconsin 4 by 6-in. power plant. This is a four-cylinder unit which is capable of handling large sized trucks. It has considerable flexibility, its stroke-to-bore ratio being 1.5

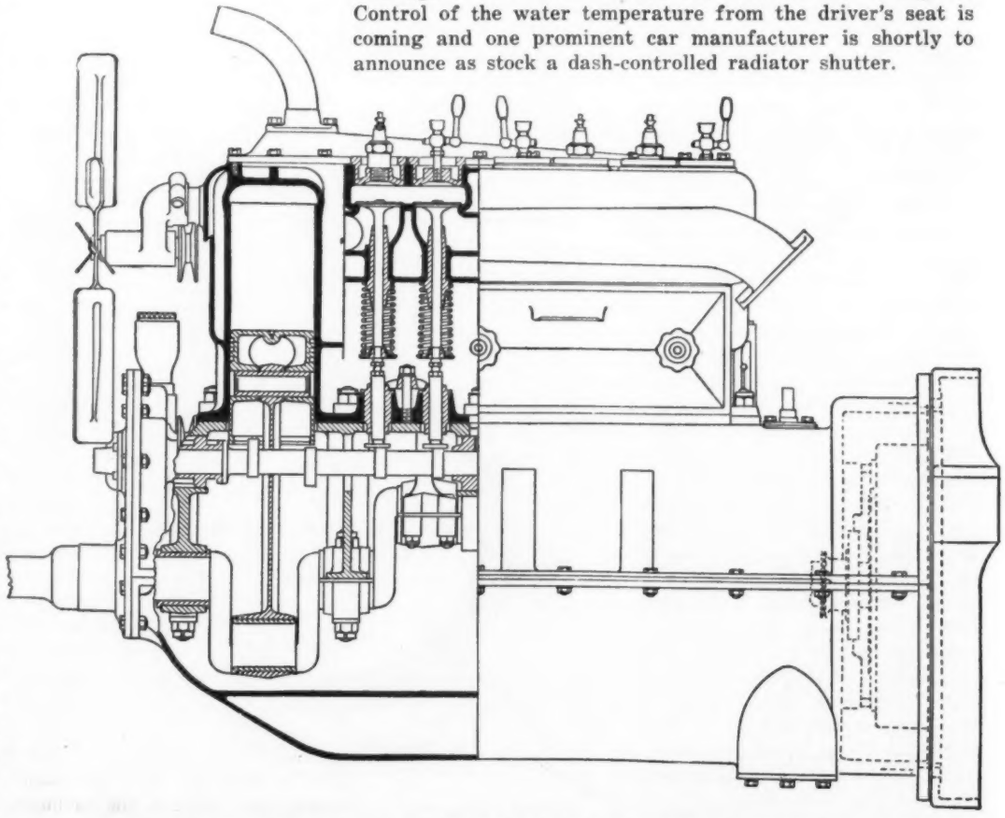
down, particularly in one instance where several cars were called in and changed over to iron pistons, it is because the pistons were made too short and secondly because the workmanship necessary to keep the clearances accurate could not be secured commercially in that particular installation.

The Eight and Twelve

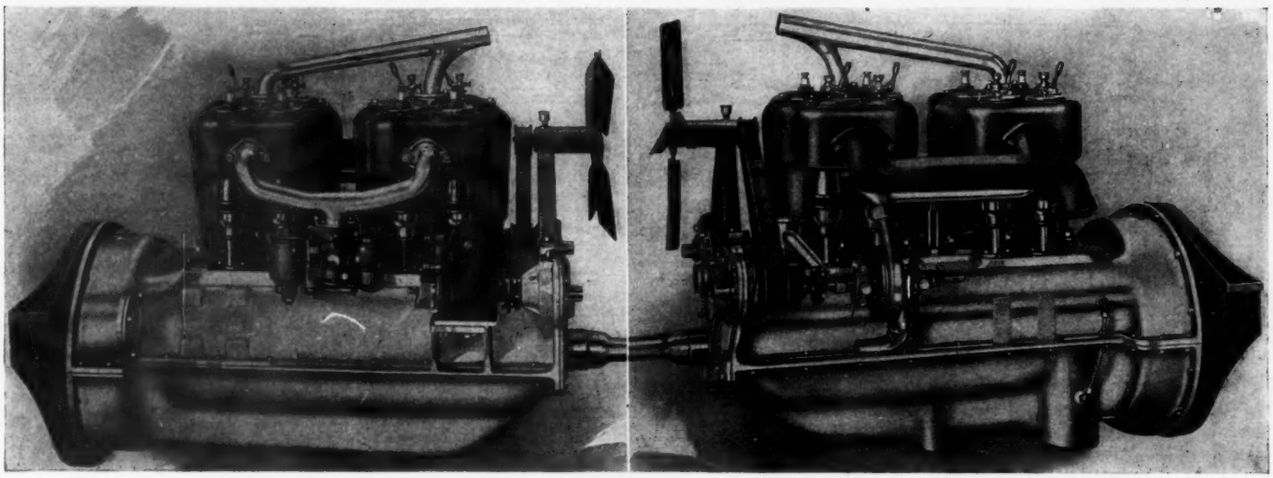
The V-engine cannot be overlooked in touching on the big points in engine practice. All doubt seems to have passed regarding its fitness. It is a question of cost versus performance. The question that each engineer must ask himself in deciding upon the building of a V-motor is whether he can get the same performance from an eight that he can from the six at the same price. The answer is both no and yes, because some have discarded the V, because they have felt that the six gives the better performance-cost answer, while with others it has been the other way around. Examples can be given on both sides so they mutually offset each other and show the point to be one that is open for debate, and since debate is stimulating and is really the key to progress, the V engine, besides having proved its fitness for the work, now stands as a champion of one type of design as opposed to the straight line variety. The shorter, stiffer shafts in the V are offset with the maintenance questions and altogether the question has various ramifications which are carried down to the limits of personal choice. During the year we have had practical demonstrations which have shown both types satisfactory.

Oiling has not changed greatly except that there is a tendency to keep the valve drive submerged so that it cannot become noisy. The details of this will be considered separately but in taking up the main trends it may be stated that oiling by circulating combination pressure and splash is typical. The oil pressure has gone up along with the speeds and now it is not uncommon to send the oil to the rubbing surfaces under a pressure of 40 lb. per square inch.

Cooling favors the pump-circulation among the motor builders. The proportion is about 66 per cent by pump and 34 per cent by thermo-syphon. The latter type of feed has been gaining for the past 3 years among the smaller engines although it has never worked out well for the V engines. Control of the water temperature from the driver's seat is coming and one prominent car manufacturer is shortly to announce as stock a dash-controlled radiator shutter.



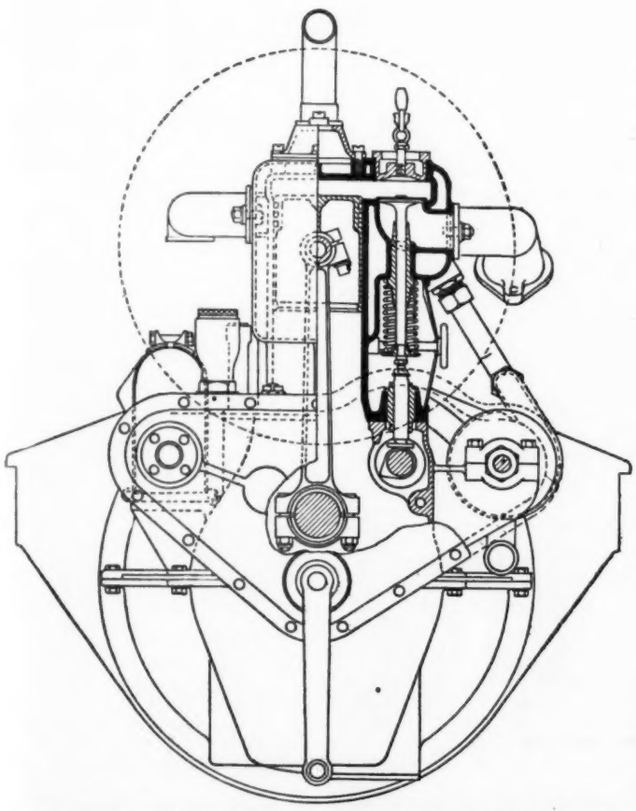
Wisconsin four-cylinder 4 by 6-in. engine which is used extensively for commercial vehicles



Wisconsin T-head engine which is known for its hard-pulling qualities. This model is a development extending over several years and has a bore and stroke of 4¾ by 5½

Part II—Mechanical and Thermal Efficiency Increased

Reduced Friction in Gas Ports, Higher Compressions and Greater Mean Effective Pressure Responsible—Maximum Piston Speeds Vary Through Wide Range



Transaverse section through the Wisconsin 4 by 6 in. truck motor

THERMAL efficiency is a measure of the power secured from a given quantity of fuel. Mechanical efficiency is a measure of the power secured from a given size of engine. The two are closely related but still are independent. In increasing each of these factors, the use of a number of detailed improvements has been made which has had a marked effect on engines as a whole.

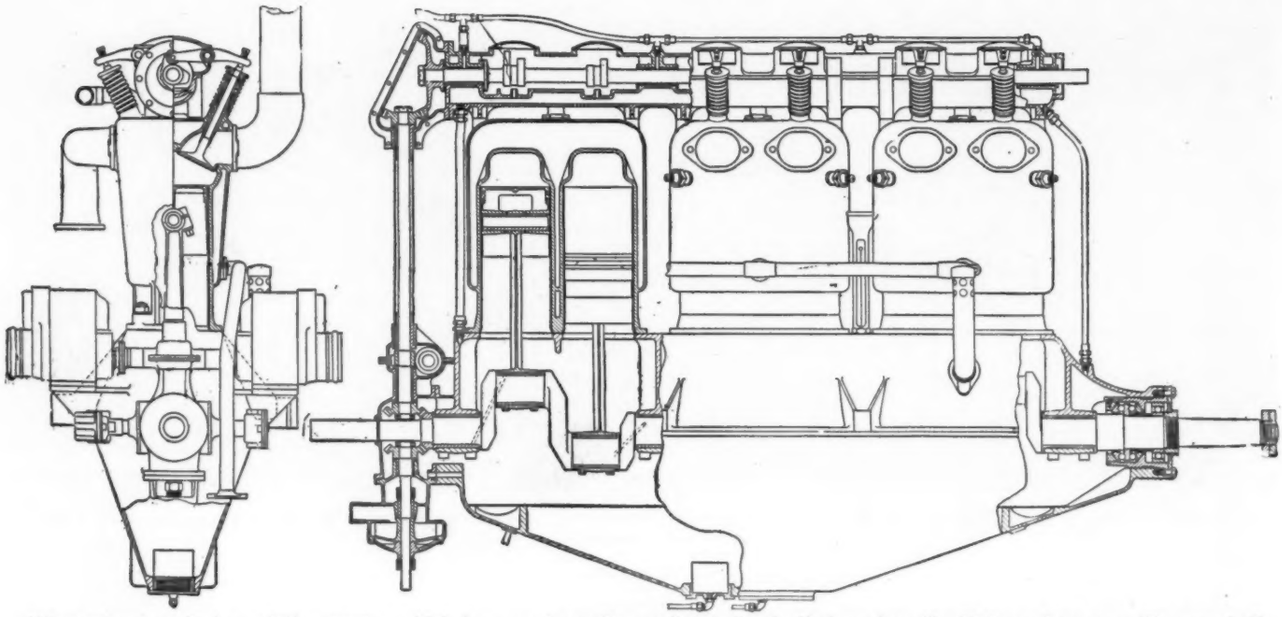
No other factor has had such attention this year as the increase in volumetric efficiency. This relationship between the volume of gas drawn into the cylinder and the volume of displacement is highly important because it is a direct measure of the relationship between the volume used and the volume wasted in an engine.

A number of factors have worked against the betterment of the volumetric efficiency, the two greatest of these being the higher speeds at which engines are operated and the second is the necessity for heating the heavier grade of fuel which is now being sold. The higher speeds have forced the engine builder to keep increasing the size of the valves year by year until in 1915 the limit was reached. It has been impossible to go any higher and consequently there has been very little alteration in this respect.

It has been discovered, though, that all the restriction of gas flow has not been in the valve but in the approach to the valve, and consequently there has been a universal house-cleaning of intake passages. The Sterling company has even given this volumetric efficiency matter such close attention that its engines have larger intake than exhaust valves.

Integral Manifolds

The use of the cored-in manifold has eliminated some of the bends in the passages, and has permitted of the direct connection between the carbureter and cylinder block. This trend is of about 4 years standing and is still on the increase.



Wisconsin six-cylinder aviation engine which has a valve action quite similar to that used on the Stutz racing cars. The camshaft is carried overhead

No notable change has been made by any of the companies in valve timing. In the overhead valve design there has been one tendency which has worked out very well and that is in the use of the offset rocker arm. In place of having the rocker with the fulcrum at the center it is off center so that the lift of the valve is magnified. The ratio then, instead of being 1 to 1, as it has been in practically every installation up to the last year, is now on a great many 1 to 2 or 3 to 5. The Falls Motor Co., which specializes on a valve-in-head design, has not adopted this practice on the ground that it would complicate replacements which would more than offset any gain.

The advantages claimed for the offset construction is that it eliminates a certain amount of inertia, owing to the smaller travel of the valve parts. This gives the effect of silencing the drive to some extent and further permits the follower to ride the cam better because of the lesser rise on the cam face. Besides this the leverage of the valve spring on the rocker arm, being greater, the spring can be reduced in tension, thereby compensating for the difference in the linkage.

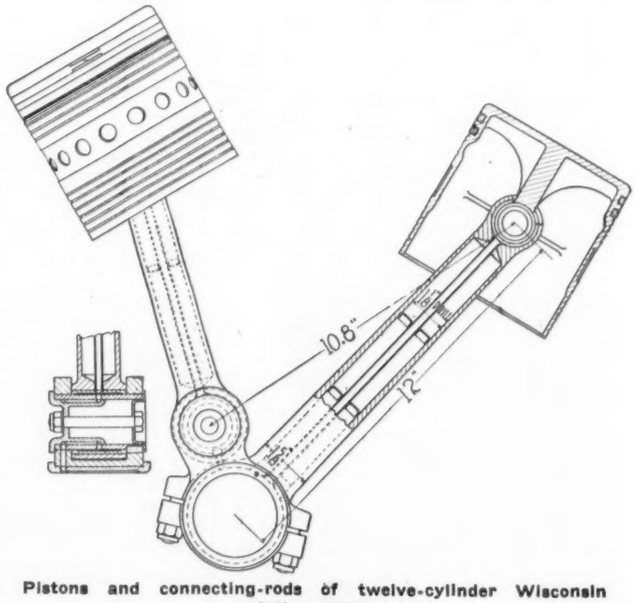
Another feature of the differential rocker is that it allows of a longer dwell of the valve, due to the quicker lift. This certainly reflects in the direction of higher volumetric efficiency as the time of maximum opening of the valve is increased and therefore a longer period is allowed for the gases to make their way into the cylinders.

Compressions are higher than they were a year ago. They vary to such an extent that it is impossible to draw a general trend. In truck motors the combustion space is quite often around 35 per cent of the piston displacement, while in motors like the Continental little six, which is a high-speed passenger car type, this percentage is about 30 or about 85 lb. absolute. The little Falls overhead job with a piston displacement of 180 in. for its six-cylinders has a compression space of 26.5 per cent of the displacement, which would give a compression average of over 90 lb. absolute.

Higher Mechanical Efficiency

The reduction in the size of the combustion space and the reduction of friction in the intake passages has more than offset the expansion of the charge due to preheating. The latter has been necessitated by the lower grade fuel, but does not seem to affect the power of the engine. Possibly combustion is more complete with the preheated and gasified charge. On a small engine being developed at the Milwaukee Machine Co. plant a novel scheme is being tried in shaping the passage below the valve in venturi fashion so that there is no break in direction of flow at the valve, but instead it gets the continuous flow effect imparted by the venturi. The throat of the venturi is just below the valve opening.

The increase in mechanical efficiency is largely wrapped up in the same matters as thermal efficiency. The higher compression has resulted in higher mean effective pressures, which in turn means a greater horsepower output from a given displacement. In the reduction of vibration due to the mechanical refinements, particularly in the crankshaft and reciprocating weights, there lies another one of the reasons for the increase in mechanical efficiency. Lower bearing friction will tend to bring this up, but it is to be doubted if this is being secured owing to the higher speeds and larger diameter shafts which have carried the linear bearing speeds close to the limit. When these rise over 1000 ft. per minute they are getting close to the limit for standard cars.



Pistons and connecting-rods of twelve-cylinder Wisconsin aviation engine

Part III—Refinements in Structure and Manufacture

Part-by-Part Study of Motors Shows That Every Detail Has Been Carefully Refined During the Year

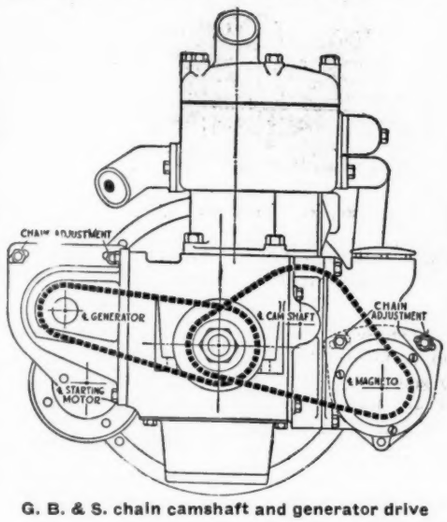
TAKING the engine part by part, it will be discovered that there is some sort of refinement in every detail. This may be in the line of economical manufacture, lighter weight or in some other direction, but there is no part of the engine which has been left untouched. In some parts the line of deviation between passenger and commercial or tractor practice becomes highly marked. In others it has been possible to cut the cost of manufacture while at the same time the efficiency of the resulting engine may actually have been increased.

Gray iron, or what is known as 15 per cent semi-steel, is the king of metals for cylinder use. The aluminum cylinder has not gained this year and will not until aluminum drops from its present price level. In manufacture the ground cylinder is favored over the reamed-in small bores, while above 3 in. there is a leaning toward the reamed finish. One or two manufacturers believe the best results are obtained by rolling. Taking engine manufacture as a whole, it may be said that reaming and grinding are about equally divided. The consensus of opinion on this subject is that the reamed finish is excellent for wearing into a finish fit, while it is easier to grind the surface of the cylinder commercially, within the desired limits.

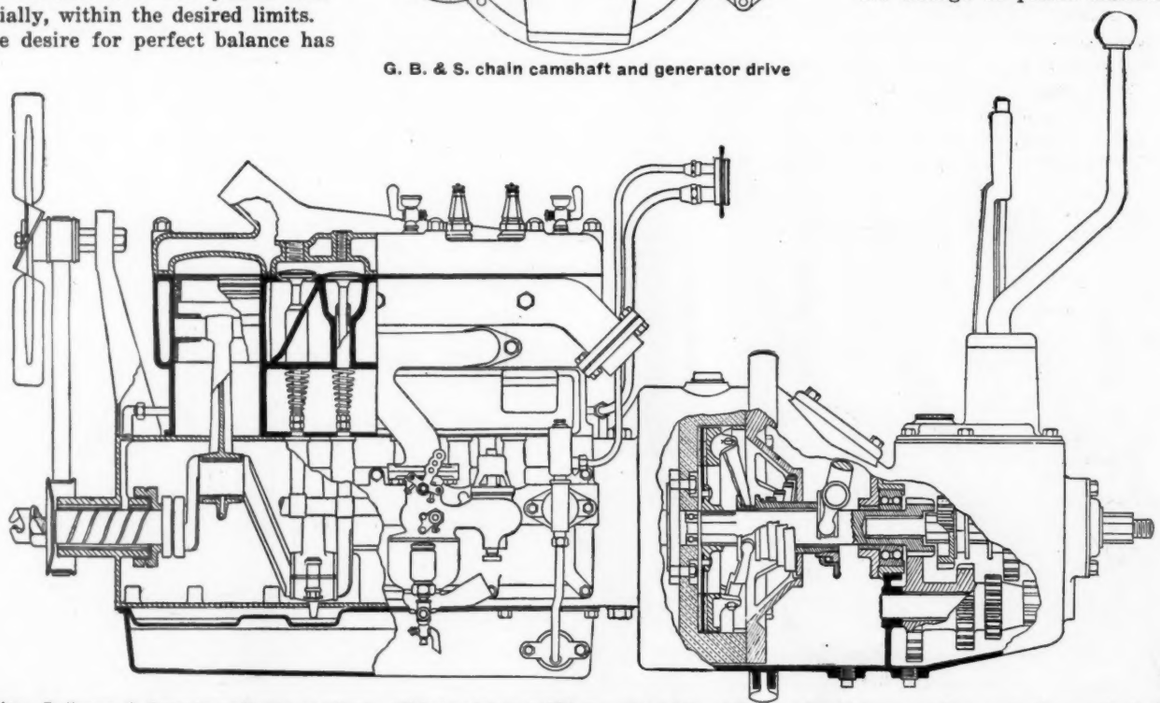
The desire for perfect balance has made the manufacture of equal combustion chamber volumes imperative. One of the Le Roi engines intended for high speed work is checked so that all combustion chambers must be accurate within 3 c.c. for volume. If desired that explosion pressures be equal on all pistons this must be done.

Another important feature in cylinder design is the question of how low the jackets should be carried. There has been a tendency all along the line to increase the water space, and jackets are universally larger. On the latest Falls motor, the waterjackets have been extended clear down to the crankcase line. In detachable head jobs, the passages for water from the main cylinder casting to the head have to be watched particularly. The Golden, Belknap and Swartz company has discontinued the detachable head because of a desire to secure better cooling in the upper part of the combustion space. This is the only instance, however, of where a detachable head has been dropped and the trend may be said to be in the opposite direction. A copper-asbestos gasket is necessary between the head and the cylinder, and any attempt to use a simple paper gasket at this point will be sure to end in failure as soon as a replacement is attempted.

No change in piston material can



G. B. & S. chain camshaft and generator drive



Golden, Belknap & Swartz unit power plant. This model is a 3¾ by 4¼ unit. Note carbureter mounting and diagonally-inclined intake manifold. Clutch and gearset details are shown at the right. End view of the engine appears above

be noted during the year, except possibly a slight backward movement toward iron where aluminum was tried a year ago. As stated, though, the aluminum question has not been settled yet. Gray iron, the same as used for the cylinders, remains far in the ascendancy.

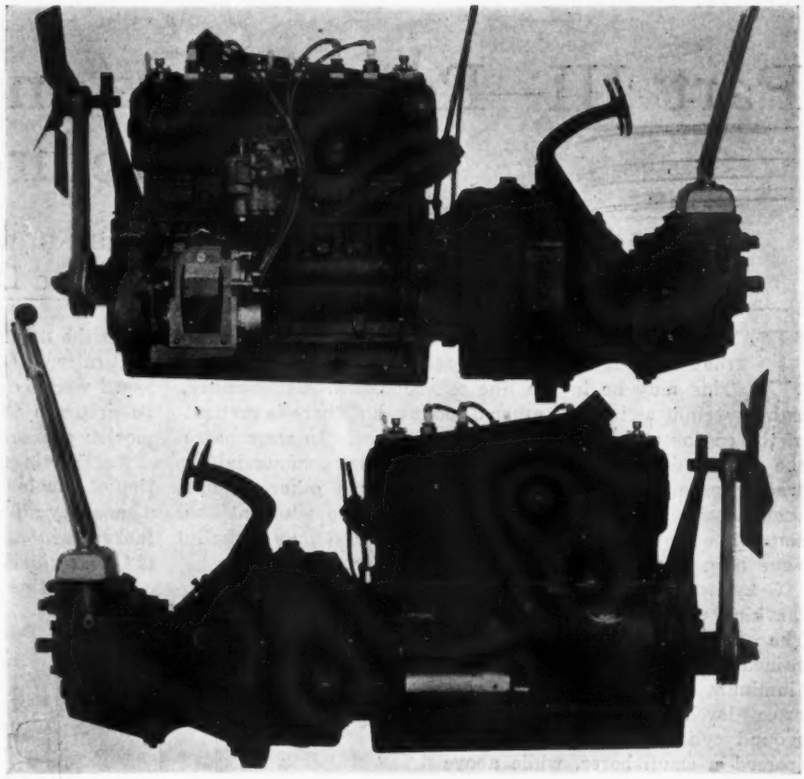
Three rings, all above the piston pin, are practically standard, although one manufacturer, the Falls company, has changed to two rings and will place one of the patent leak-preventers in the top of each unit. For very high speeds two rings are enough, for the lower speeds it requires three eccentric rings to do the work.

Clearances on passenger car pistons have not changed during the year. On tractor work where the engine operates in a cloud of dust that cannot be altogether excluded, the larger clearances have been found necessary. On the Waukesha tractor motor, for example, with the 4¾-in. bore there is a piston clearance at the top of 0.018 in., which is more than double that of the corresponding passenger car engine with iron pistons.

Although cast iron remains as the chief piston metal, pistons have been made very much lighter all along the line. The skirts are thinner and the piston pin boss is not taking so much metal. The pistons are being carefully lapped to the cylinders by many, and in the Continental factory there is an interesting special machine which laps the cylinder by means of a dummy piston. On the little high-speed Le Roi engine the piston skirt is drilled all over with large holes for lightness.

On the Falls motor the piston pin has been lowered slightly and the difference has been taken off the connecting-rod length. A little piston kink that is used by some with good results is to taper off the top of the piston so that the oil instead of gathering on the head of the piston will gather in the space around the outside diameter, thus tending to feed itself between the piston and the wall.

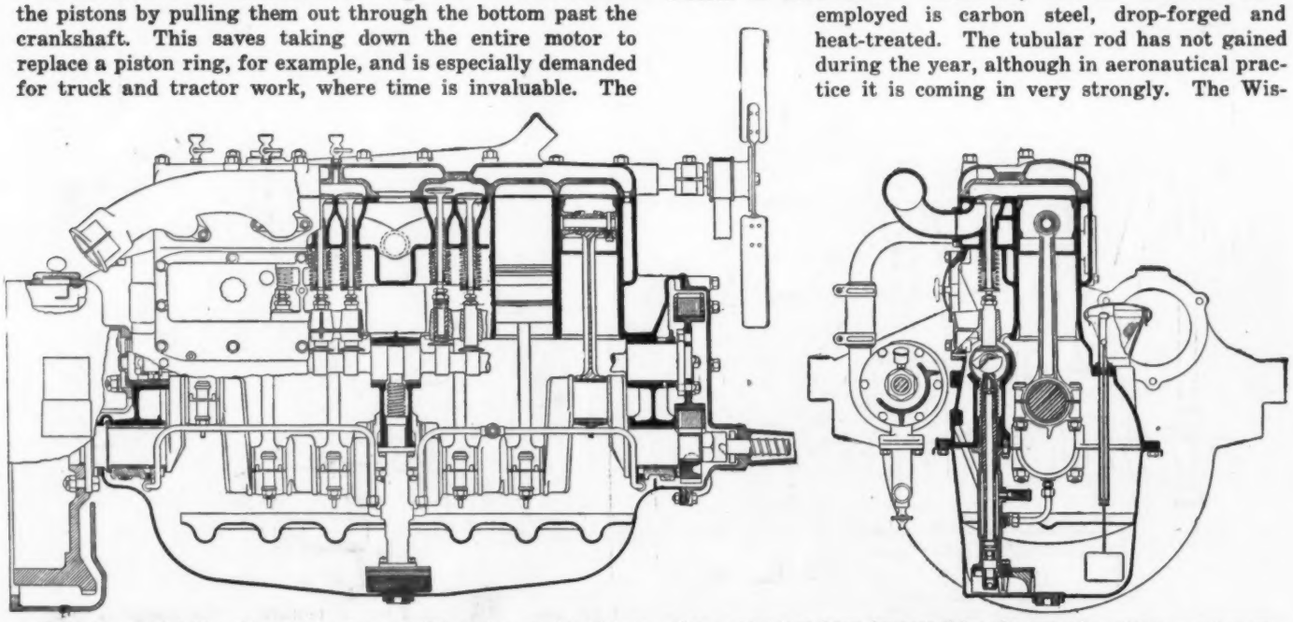
On all motors it is a desirable thing to be able to remove the pistons by pulling them out through the bottom past the crankshaft. This saves taking down the entire motor to replace a piston ring, for example, and is especially demanded for truck and tractor work, where time is invaluable. The majority of motors are being designed in this way, and no doubt others will rapidly fall into line. A slight difference in tractor practice, as compared with passenger cars, is that it is generally thought desirable to put the upper rod bearing in the piston boss with a solid connection to the rod. This is on account of a gain in bearing area. This practice is not universal, however.



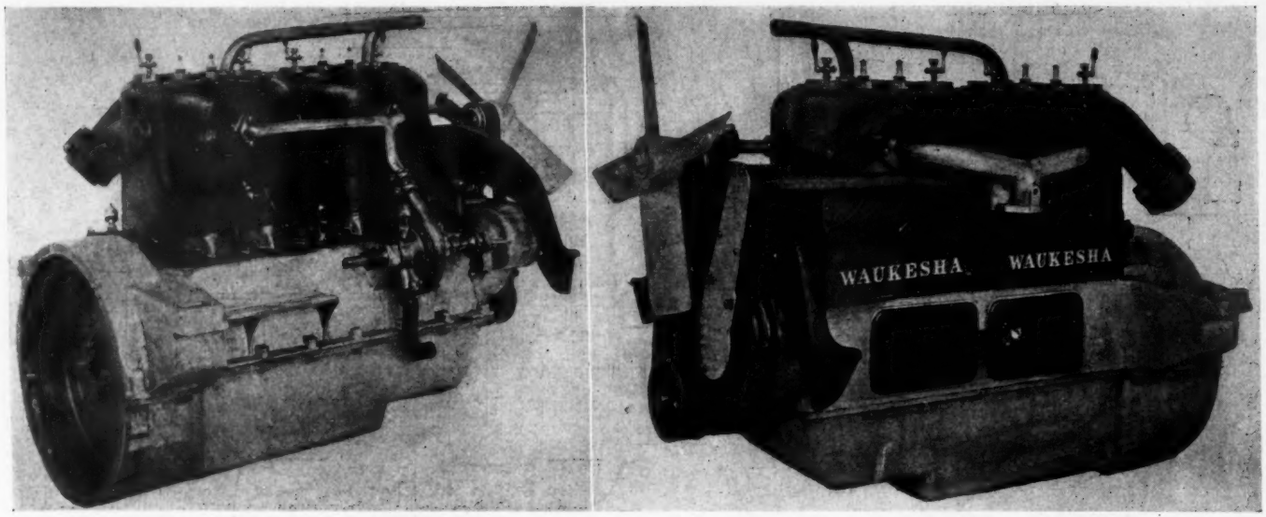
Golden, Belknap & Swartz unit power plant with L-head cylinders for small vehicles

Connecting-Rods

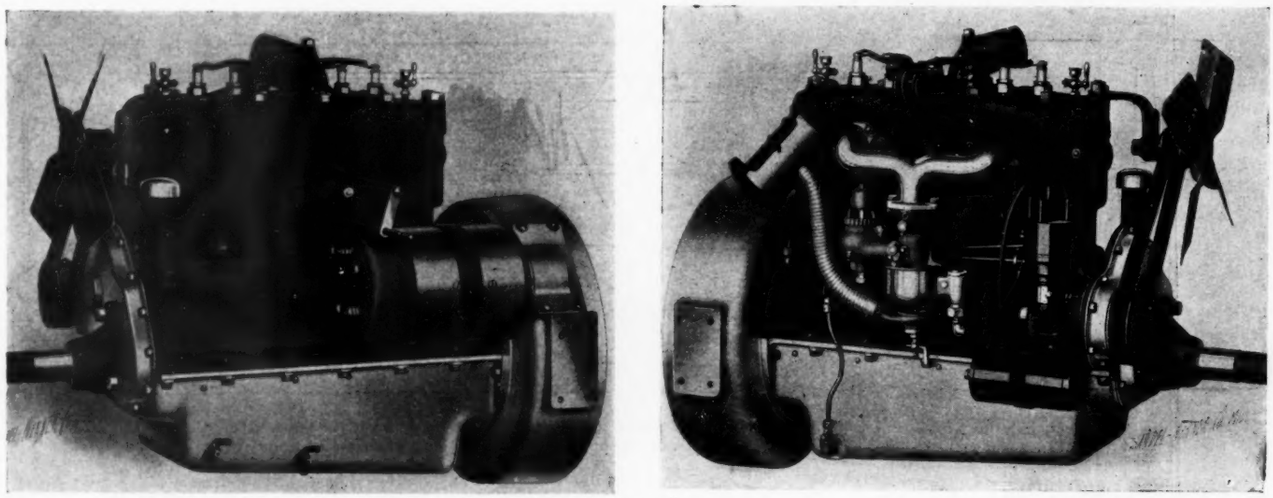
Little change will be found in rod practice. The straight I-beam is used almost universally and the material most employed is carbon steel, drop-forged and heat-treated. The tubular rod has not gained during the year, although in aeronautical practice it is coming in very strongly. The Wis-



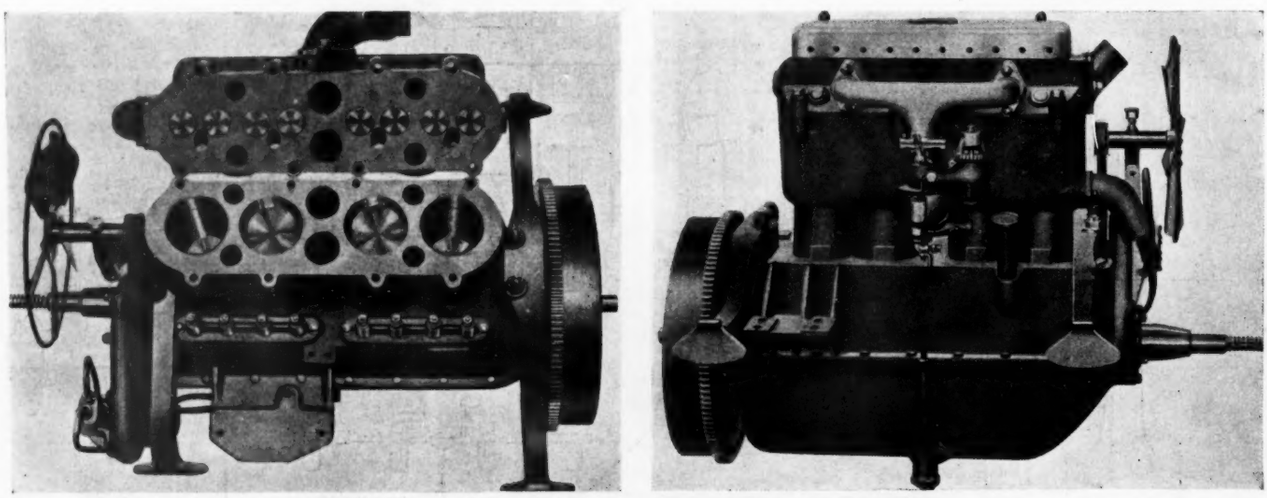
Rutenber model 25, which has a bore of 3⅛ and a stroke of 5 in. This model has been improved by the use of a stiffer crankshaft and is larger in bore than its predecessor, giving altogether a more powerful and efficient design



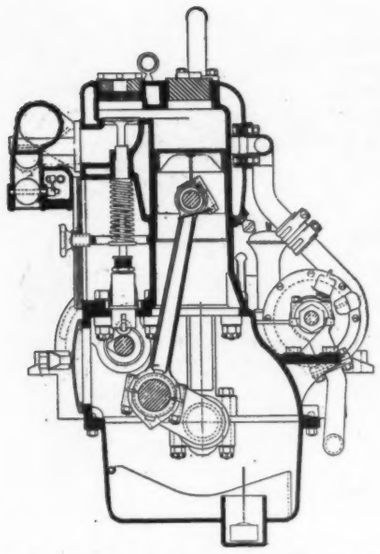
Both sides of a Waukesha engine which is used extensively on tractors. Note how carefully all the moving parts are inclosed to guard against the abrasive action of the gritty dust in which tractors are generally compelled to work



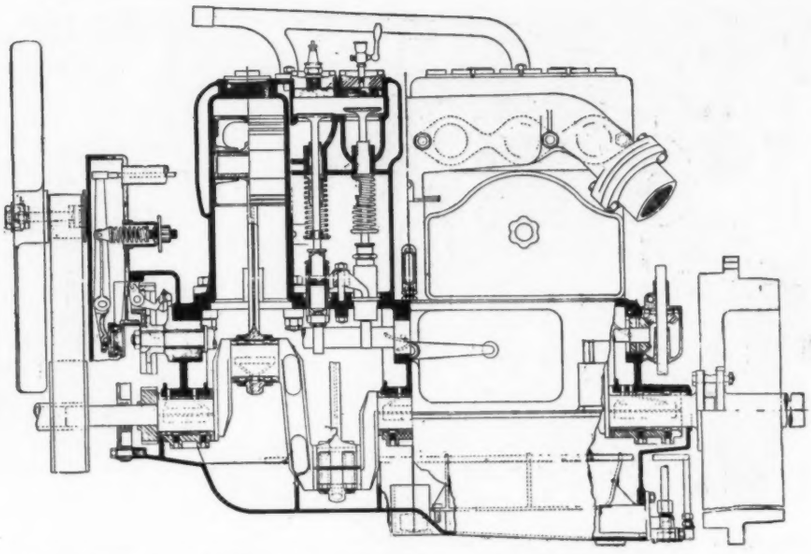
Both sides of the 3⅛ by 4½-in. four-cylinder Le Roi engine, which is designed for light commercial or passenger car work. Note mounting of electrical units and arrangement of manifolds



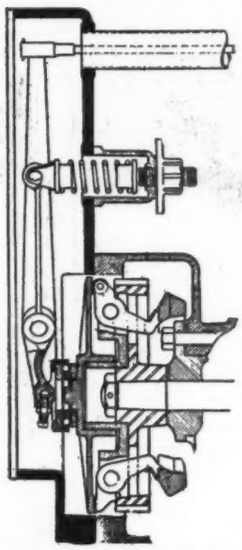
Two views of the four-cylinder Beaver model M L which has a bore of 3½ and a stroke of 5 in. A feature of this design is the detachable cylinder head, the illustration at the left giving an idea of the accessibility of the combustion chamber with this arrangement, while the one at the right shows the intake side of the engine



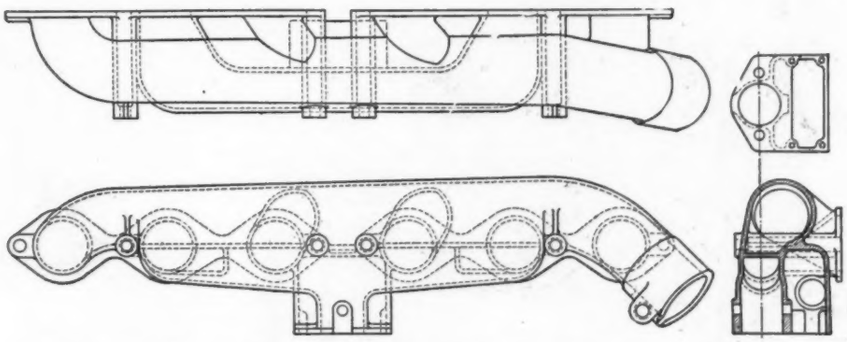
End section through the Waukesha 4½ by 6¾-in. engine, showing the valve and piston assembly details



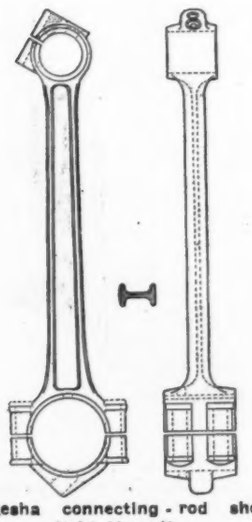
Longitudinal part section of 4½ by 6¾-in. four-cylinder Waukesha, showing mounting of governor behind the fan. Note combined intake and exhaust manifold



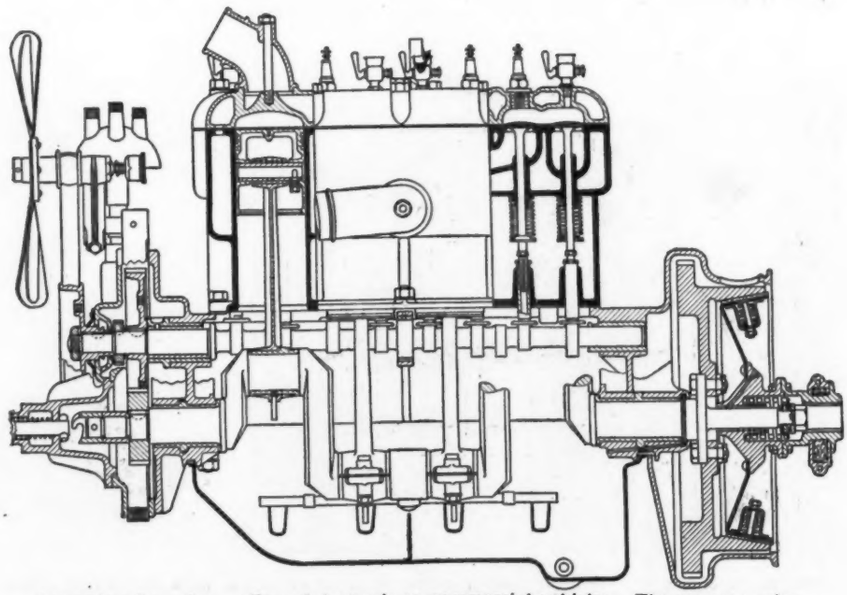
Enlarged view of governor on 4½ by 6-in. Waukesha model



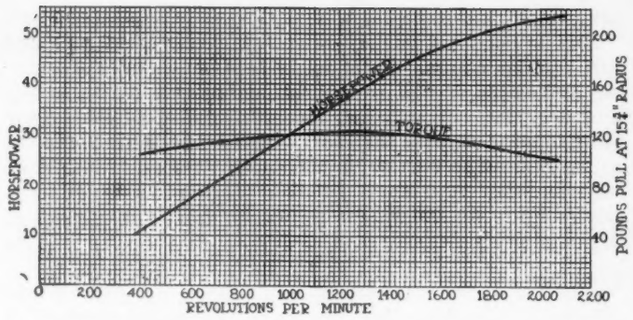
Combined intake and exhaust manifold which is a feature of the 4½ by 6-in. Waukesha, aiding in the vaporization of heavy fuel



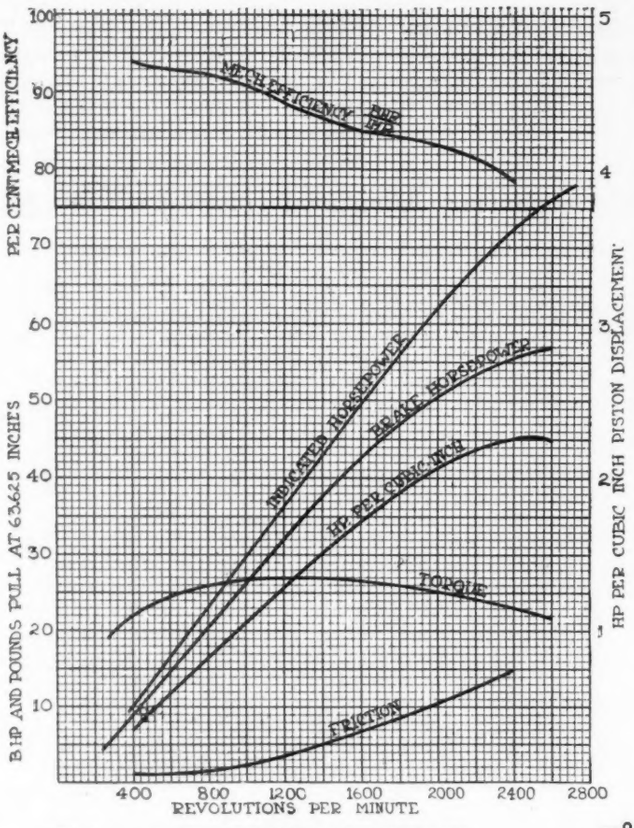
Waukesha connecting-rod showing light H-section



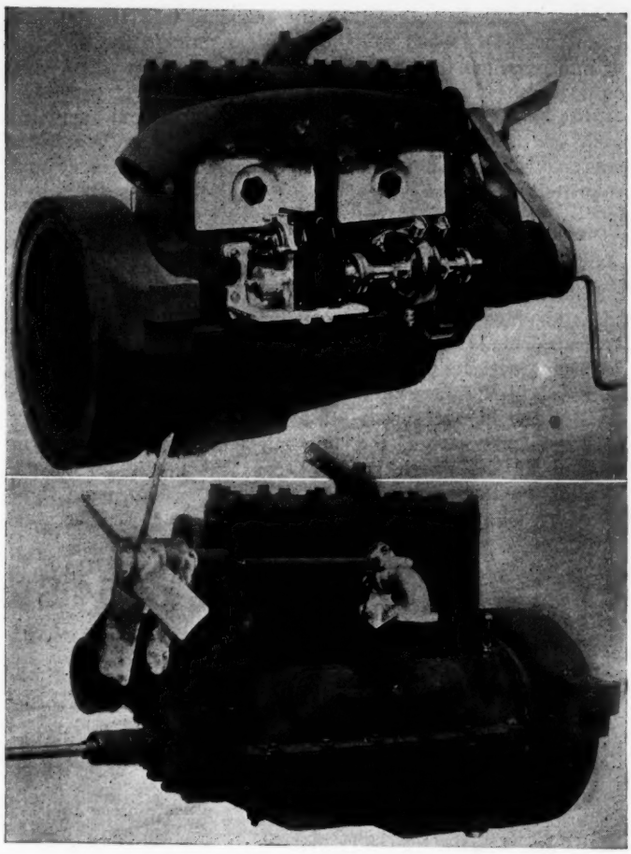
Lycoming four, for medium duty work on commercial vehicles. The generous size of the gas ports and the water passages surrounding the valves is indicative of present trends in this direction



Horsepower and torque curves of 3½ by 5⅛-in., six-cylinder Buda motor fitted with 1¼-in. carbureter



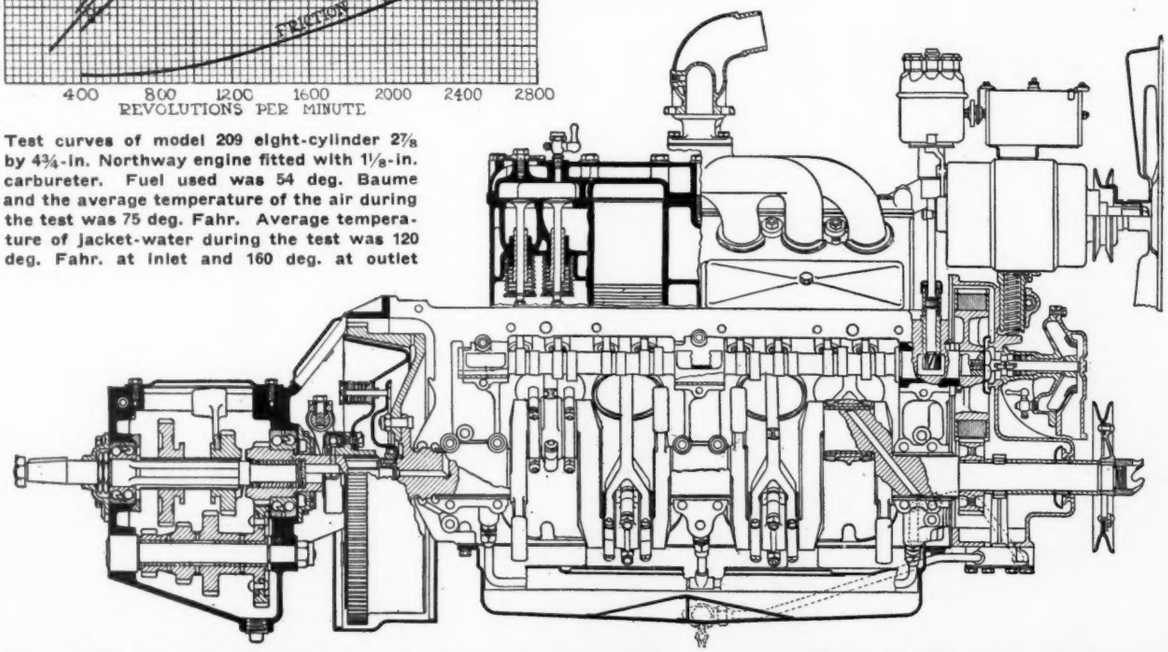
Test curves of model 209 eight-cylinder 2⅞ by 4¾-in. Northway engine fitted with 1⅛-in. carbureter. Fuel used was 54 deg. Baume and the average temperature of the air during the test was 75 deg. Fahr. Average temperature of jacket-water during the test was 120 deg. Fahr. at inlet and 160 deg. at outlet



Waukesha motor intended for tractor service. Combined intake and exhaust manifold aids vaporization of kerosene

consin aeronautical motor has the rods made from solid billet steel. Needless to say this practice is far beyond automobile work except for special cases such as racing.

The shorter rod of the Falls motor, due to the dropping of the piston pin, is the only example where rod lengths have been changed.



Northway eight. Note the single three-bearing, sixteen-cam shaft and the use of the forked rods. Both of these points have been much discussed in eight-cylinder practice and this engine is typical of this class of motor

Where manufacturers take the pains to mill off the flash from the drop forged rod they make a gain in the direction of lightness, but it is a time-consuming operation which must be done carefully. In carrying out the balancing operation, all the makers of engines weigh the rods in sets and equalize each set of rods and at the same time keep the centers of mass at corresponding points on each rod, within very narrow limits.

Crankshafts

Crankshafts are still growing stiffer. They are larger in diameter and at the same time shorter. Rutenber has a 2-in. shaft in place of a 1¾ on its standard model 25, and this is typical. This is one of the points in which passenger car and tractor practice approach each other for entirely different reasons. In the passenger car the stiffness is needed to take care of the higher speeds. In tractor work the stiffness is needed to take care of the constant racking of the engine on account of the rough work at constant maximum torque. Tractor engines must stand up. Two days may mean thousands of dollars in crop loss to a large farmer and he must have tractor engines that will work right along indefinitely.

Furthermore, on tractor work the ever-present grit and dust problem enters. It cannot be kept out in spite of washing apparatus on the carbureter and double filters in the breather pipe. It will get into the engine, and the only thing to do is to make the shaft so hard that it cannot be cut by the grit. The Waukesha motor, for example, uses a heavy chrome nickel steel shaft in which the tensile strength is carried up to 140,000 lb. per sq. in. and of a scleroscope test that almost equals tools steel.

Valve Actions and Drives

Silent chain drive has not gone ahead in the last 2 years for camshaft drives. The wide-faced helical gear seems to be about the most popular, and the use of Fabroil, Micarta and other compressed materials is looked upon favorably by a great many. The Waukesha is using a drop-forged gear, which the company believes to be best for the rough work of tractors, especially in that non-resonance is not such a great necessity. In passenger car practice, on the other hand, silence is greatly to be desired, and hence wider faces,

Specifications of 54 Stock Engine Models for 1917 Produced

MAKE AND MODEL	No. of Cylinders	Piston Displacement, Cu. In.	Bore and Stroke in In.	Cylinders Cast	Valves Placed	Valve Diameter in In.	Exhaust Valve Lift	Piston Length in In.	No. of Piston Rings	Weight of Piston in Oz.	Weight Connecting-Rod in Oz.	Length of Connecting-Rod in In.	Width Wristpin Bearing in In.	Diameter Wristpin Bearing in In.
Beaver ML	4	192.40	3½x5	block	head	1 7/16	5/16	.....	3	.....	.....	.....	1⅛	¾
Buda HU	4	312.00	4¼x5½	block	right	1⅞	½	5½	3	71¼	96½	12½	2⅛	1¼
Buda IU	4	276.50	4 x5½	block	right	1⅞	½	5½	3	.....	96½	12½	2⅛	1¼
Buda RU	4	197.23	3½x5½	block	right	1½	½	5	3	46	57½	11½	1⅞	1 7/16
Buda YU	4	381.70	4½x6	block	right	2⅛	½	6½	3	98½	119½	13½	2⅛	1½
Buda LSU	6	303.10	3½x5½	block	right	1½	½	5	3	46	57½	11½	1⅞	1 7/16
Buda SSU	6	364.48	3½x5½	block	right	1 11/16	½	5	3	55½	66½	12½	2	1
Continental N	4	192.40	3½x5	block	right	1 47/64	10/27	3½	3	.....	50	10½	1½	1 11/32
Continental C-4	4	280.60	4½x5½	block	left	2	15/49	5½	3	.....	.....	11	1¾	1 8/37
Continental E-4	4	349.90	4½x5½	pairs	left	1 31/32	18/49	5½	3	.....	.....	12	.....	1½
Continental 7-W	6	224.00	3½x4½	block	right	1 7/16	9/32	3	3	30	25	8½	1½	¾
Continental 7-N	6	303.10	3½x5½	block	right	1 11/16	20/59	3½	3	.....	50	10½	2 7/16	1 11/16
Davis SD	4	113.10	3 x4	block	right	1¼	7/32	3	3	28	29½	8	1⅛	1⅛
Falls I-T	6	180.20	3 x4½	block	head	1½	9/32	3½	3	28	28	8½	⅞	37/50
Falls J	6	180.20	3 x4½	block	head	1½	9/32	3½	3	28	28	8½	⅞	37/50
Ferro 9	8	198.00	3 x3½	block	head	1½	7/32	3 3/16	3	.....	.....	7	1½	¾
Ferro 8	8	265.00	3½x4	block	head	1⅜	7/32	3 7/16	3	.....	.....	8	1½	1
Ferro 13	8	162.00	2½x3½	block	head	1 7/16	3/11	3	3	.....	.....	7	1⅛	37/50
Hercules C-2	4	226.40	3½x5½	block	left	.....	.....	.....	5	.....	.....	.....	.....	.....
Hercules C	4	197.20	3½x5½	block	right	.....	.....	.....	5	.....	.....	.....	.....	.....
Hercules M	4	276.50	4 x5½	block	left	.....	.....	.....	5	.....	.....	.....	.....	.....
Hercules M-2	4	312.00	4¼x5½	block	right	.....	.....	.....	5	.....	.....	.....	.....	.....
Le Roi C	4	138.40	3½x4½	block	.....	1⅜	.....	.....	.....	.....	.....	.....	.....	⅝
Light H	4	149.30	3½x4½	block	right	1⅜	11/32	4	3	28	39	9	1⅛	⅝
Lycoming DU	4	165.90	3½x5	block	right	1⅜	15/49	4	3	34	46	9½	1 7/16	⅝
Lycoming U	4	165.90	3½x5	block	right	1⅜	15/49	4	3	34	46	9½	1 7/16	⅝
Lycoming DXU	4	192.40	3½x5	block	right	1⅜	15/49	4	3	40	46	9½	1 7/16	⅝
Northway 108	6	177.00	2½x4½	block	head	1⅛	7/32	3 7/16	3	51	22	9	1½	¾
Northway 209	8	246.70	2½x4½	block	right*	1⅛	11/32	3½	4	†63 3/20	†28 3/20	9½	1½	¾
Northway 309	8	346.30	3½x4½	block	left*	1½	11/32	4½	4	†77	†41	9½	1½	6/7
Northway 308	8	346.30	3½x4½	block	left*	1½	11/32	4½	4	†80	†35	9½	1½	6/7
Rutenber T	4	192.40	3½x5	block	head	1⅜	7/32	3 13/16	3	40	31½	9½	1⅜	⅞
Rutenber 38	4	294.00	4¼x5½	pairs	right	1⅞	11/32	5	3	67	67	12	2	1
Rutenber 25	6	230.00	3½x5	block	right	1 7/16	7/32	3½	3	27½	31½	9½	1½	⅞
Sterling 20	4	120.20	3 x4½	block	head	1½	7/32	3½	3	24	24	7½	1½	37/50
Teetor H	6	230.10	3½x5	block	right	1⅜	7/32	3 7/16	4	27	47	9½	1	1
Teetor T17	6	572.50	4½x6	block	opp	2 7/16	11/32	5	4	58	58	12½	1½	1
Waukesha TU4	4	202.00	3½x5½	block	right	1⅜	7/32	3½	3	41	66	10½	2	1
Waukesha B	4	231.90	3¾x5½	block	right	1⅝	7/32	3½	3	46	90	11½	2	1
Waukesha R	4	327.00	4½x5½	pairs	right	2	7/32	5½	3	80	76	11½	2½	1½
Waukesha M	4	430.00	4½x6½	pairs	right	2⅛	11/32	5½	3	90	94	12½	2½	1½
Weidely 4 D	4	211.60	3½x5½	block	head	1½	7/32	4½	3	38½	73	11	2	1
Weidely 12 C	12	390.00	2½x5	threes	head	1 7/16	1/4	3½	3	22	41½	10	1⅛	¾
Wisconsin J	4	449.60	5 1/10x5½	pairs	opp	2½	½	6	3	103	106	12	3	1 7/16
Wisconsin JU	4	449.60	5 1/10x5½	pairs	opp	2½	½	6	3	103	106	12	3	1 7/16
Wisconsin A	4	389.90	4½x5½	pairs	opp	2½	½	6	3	96	106	12	2½	1 7/16
Wisconsin AU	4	389.90	4½x5½	pairs	opp	2½	½	6	3	96	106	12	2½	1 7/16
Wisconsin QU	4	166.00	3½x5	block	left	1½	7/16	3½	2	34	44	10	2½	¾
Wisconsin TU	4	302.00	4 x6	block	left	2	7/16	5½	3	59	85	12	2½	1 7/16
Wisconsin UU	4	341.00	4½x6	block	left	2	7/16	5½	3	80	85	12	2½	1 7/16
Wisconsin D	4	606.00	5½x7	pairs	opp	2⅜	½	7	4	128	148	14	3½	1 7/16
Wisconsin M	4	727.00	5½x7	pairs	opp	2⅜	½	7	4	156	148	14	4	1 7/16
Wisconsin K	6	909.00	5½x7	pairs	opp	2⅜	½	7	4	128	148	14	3½	1 7/16
Wisconsin P	6	1090.00	5½x7	pairs	opp	2⅜	½	7	4	156	148	14	4	1 7/16

*Optional. †With forked rod-blade rod lighter. ABBREVIATIONS: Opp, *opposite;* ext-man, *external manifold;* int-pas, *internal passage;* cent

compressed fabric gears, the helical pitch and occasionally silent chain drive.

Camshafts have not been altered materially. In fact timing and cam contours have not changed much in the last 3 years. Where the offset rocker has been adopted it has, of course, necessitated a change in the cam, but the average timing will not be found to be much altered. There is a surprisingly small difference between commercial and passenger car work, the latter being slightly more advanced for the higher speed. Exhaust valve opening at 45 deg. before lower center is about the average, while for a few passenger cars it will run nearer 55 deg.

In construction, the valve operating parts have been made lighter. There is quite a trend towards hollow push rods. Waukesha, Northway and Falls have all adopted them this year. The high speeds of the valves have called for a reduction in the inertia of the moving parts through decreased weight. If this inertia is not decreased the followers will not cling to the cams. Steel tubing is used for the push rod, and this is fastened by welding or expanding to the solid steel-hardened follower.

Followers of the mushroom type are growing rapidly and the roller design seems to be falling off among the motor specialists. There is generally an offset on the follower to distribute cam wear. This is secured through the simple means of making no accurate determination of the push rod axial center, so the variations in the casting will give the offset.

Valves

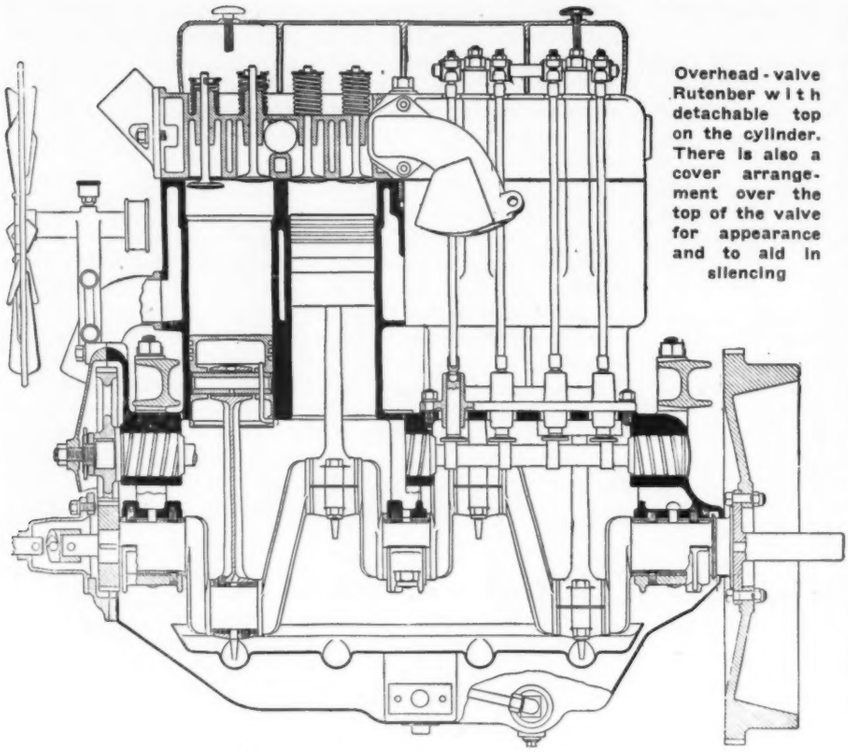
Valve sizes, as stated before, have not changed much. There are quite a number of theories on the subject. For instance, one engineer will say that in truck motors the gas velocities have to be higher in order to take care of the lower grade fuel now on the market. Another truck motor engineer will state that the truck engine valves have to be larger in order to secure the higher volumetric efficiencies at lower speeds. As a matter of fact, practically everyone is going just as large as he believes safe in valve sizes.

Tungsten for valves is rather high in price. The natural result is experiments with other alloys. Wisconsin is using tungsten, and so is Northway, while Waukesha has found 3½

by 17 Manufacturers, Including Principal Dimensions

Width Connecting-Rod Lower End Bearing in In.	Diameter Connecting-Rod Lower End Bearing in In.	Diameter Crankshaft	No. Crankshaft Bearings	LENGTH OF CRANKSHAFT BEARINGS				Intake	Water Circulation	Motor Lubrication	Material of Crankcase	Material Cylinders	Material Piston	MAKE AND MODEL
				Front	1st Inter.	2nd Inter.	Rear							
2	1⅞	2	3	2¼	2	.....	3¾	ext-man	thermo*	circ-spl	.....	iron	iron	Beaver ML
2½	2½	.....	3	3½	2¾	.....	4	int-pas	cent	pres	iron	iron	iron	Buda HU
2½	2½	.....	3	3½	2¾	.....	4	int-pas	cent	pres	iron	iron	iron	Buda IU
2	1⅞	.....	3	2¼	2¼	.....	3¼	int-pas	thermo	circ-spl	alum*	iron	iron	Buda RU
3	2½	.....	3	3½	3½	.....	4½	int-pas	cent	pres	iron	iron	iron	Buda YU
2	1⅞	.....	4	2¼	2¼	2¼	3¼	int-pas	cent	circ-spl	alum*	iron		Buda LSU
2	2	.....	4	3¼	2¼	2¼	4	ext man	cent	circ-spl	alum	iron	iron	Buda SSU
2 3/16	1⅞	1⅞	3	3½	2¼	.....	3 3/16	int-pas	cent*	sp-pres	alum	iron	iron	Continental N
2 10/37	2	2	3	2¼	3	.....	4 1/32	int-pas	cent*	circ-spl	alum	iron	iron	Continental C-4
3	2½	2½	3	3 1/16	3¼	.....	4 1/16	int-pas	.....	circ-spl	alum	iron	iron	Continental E-4
2	1⅝	1⅝	3	2 14/25	3	.....	3 1/32	int-pas	cent	sp-pres	iron	iron	iron	Continental 7-W
2 3/16	2¼	2¼	3	2¼	2½	.....	3 1/32	int-pas	cent	sp-pres	alum	iron	iron	Continental 7-N
1½	1½	1½	2	2	.....	.....	2 11/16	int-pas	thermo	circ-spl	iron	iron	iron	Davis SD
1¾	1 7/16	1 7/16	3	2 13/16	2	.....	3	int-pas	thermo	sp-pres	iron	iron	iron	Falls I-T
1¾	1 7/16	1 7/16	3	2 13/16	2	.....	3	int-pas	thermo	sp-pres	iron	iron	iron	Falls J
2	1½	1½	3	2¼	2¼	.....	3	ext-man	thermo	pres	iron	iron	iron	Ferro 9
2¼	1⅝	1⅝	3	2¼	2½	.....	3¼	ext-man	thermo	pres	iron	iron	iron	Ferro 8
1	1¼	1¼	2	2 10/19	.....	.....	2¼	ext-man	thermo	pres	iron	iron	iron	Ferro 13
.....	.....	.....	5	.....	.....	.....	.....	ext man*	gear	pres	iron*	iron	iron	Hercules C-2
.....	.....	.....	5	.....	.....	.....	.....	ext-man*	gear	pres	alum*	iron	iron	Hercules C
.....	.....	.....	5	.....	.....	.....	.....	ext-man*	cent	pres	iron*	iron	iron	Hercules M
.....	.....	.....	5	.....	.....	.....	.....	ext-man*	cent	pres	iron*	iron	iron	Hercules M-2
.....	.....	.....	.....	.....	.....	.....	.....	ext-man	thermo	circ-spl	alum	.....	.....	Le Roi C
2	1½	1½	2	2¼	.....	.....	2¾	int-pas	thermo	.....	.....	.....	.....	Light H
2⅛	1⅝	1½	2	3½	.....	.....	3 1/16	int-pas	thermo	circ-spl	iron	iron	iron	Lycoming DU
2⅛	1⅝	1½	2	3½	.....	.....	3 1/16	int-pas	thermo	circ-spl	iron	iron	iron	Lycoming U
2⅛	1⅝	1½	2	3½	.....	.....	3 1/16	int-pas	thermo	circ spl	iron	iron	iron	Lycoming DXU
1⅞	1⅝	1⅝	3	2¼	1½	.....	2 1/16	ext-man	cent	circ-spl	iron	iron	iron	Northway 108
2 5/39	2⅛	2⅛	2	3½	.....	.....	3½	ext-man	cent	pres	iron	iron	iron	Northway 209
2⅛	2⅛	2⅛	3	3½	3	.....	3 1/16	ext-man	cent	pres	iron	iron	alum	Northway 309
2⅛	2⅛	2⅛	3	3½	3	.....	3 1/16	ext-man	cent	pres	iron	iron	alum	Northway 308
2	1⅝	2	3	2¼	2	.....	3 3/16	ext-man	thermo	circ-spl	iron	iron	iron	Rutenber T
2½	2⅛	2½	3	3½	3	.....	4½	ext-man	cent	pres	iron	iron	iron	Rutenber 38
1¾	2	2	3	2¼	2¼	.....	3¼	int-pas	cent	sp-pres	iron	iron	iron	Rutenber 25
1½	1 7/16	1 7/16	2	3	.....	.....	3	ext-man	thermo	circ-sp	iron	iron	alum*	Sterling 20
1 11/16	1⅞	2	3	2¼	2½	.....	3	int-pas	cent	sp-pres	iron	iron	iron	Teetor H
1⅞	1⅞	2	4	4	1½	1½	4	int-pas	cent	sp-pres	alum	iron	iron	Teetor T17
2½	2	2	3	2¼	2½	.....	3	int-pas	thermo*	circ-spl	iron	iron	iron	Waukesha TU4
2½	2	2	3	2¼	2½	.....	3	int-pas	cent*	circ-spl	alum	iron	iron	Waukesha B
2⅜	2	2	3	2 7/16	3¼	.....	3½	ext-man	cent	circ-spl	alum	iron	iron	Waukesha R
3	2	2	3	3½	4¼	.....	4½	ext-man	cent	circ-spl	alum	iron	iron	Waukesha M
2¼	2	2¼	3	2½	2½	.....	4	ext-man*	cent	sp-pres	iron	iron	iron	Weidely 4 D
1 7/16	2	2½	3	2½	2¼	.....	4	int-pas	cent	sp-pres	alum	iron	iron	Weidely-12 C
3⅛	2	2	3	3½	3½	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin J
3½	2	2	3	3½	3½	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin JU
3½	2	2	3	3½	3½	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin A
3½	2	2	3	3½	3½	.....	4	ext-man	cent	pres	alum	iron	iron	Wisconsin AU
2	2	2	2	3	.....	.....	3½	int-pas	thermo	circ-spl	iron	iron	iron	Wisconsin QU
3	2	2	4	2½	2½	2½	3½	ext-man*	cent	pres	alum	iron	iron	Wisconsin TU
3	2	2	4	2½	2½	2½	3½	ext-man*	cent	pres	alum	iron	iron	Wisconsin UU
3½	2½	2½	3	4	4	.....	6	ext-man	cent	pres	alum	iron	iron	Wisconsin D
3½	2½	2½	3	4	4	.....	6	ext-man	cent	pres	alum	iron	iron	Wisconsin M
3½	2½	2½	4	4	4	4	6	ext-man	cent	pres	alum	iron	iron	Wisconsin K
3½	2½	2½	4	4	4	4	6	ext-man	cent	pres	alum	iron	iron	Wisconsin P

entrifugal pump; thermo, *thermo-syphon;* circ. spl, *circulating splash;* pres, *pressure;* spl pres, *splash pressure;* alum, *aluminum;* gear, *gear pump.*



Overhead-valve Rutenber with detachable top on the cylinder. There is also a cover arrangement over the top of the valve for appearance and to aid in silencing

per cent nickel steel very satisfactory. Another concern is experimenting with chrome nickel, and a few who cannot secure the material at commercial prices are trying other alloys. There is also a strong contingent in favor of the cast iron valve.

Oiling Systems

Higher pressures are used in oiling to compensate for the higher speeds. In the engines made by passenger car manufacturers there has been a tendency towards full pressure feed. This has been followed to some extent by the motor manufacturers. The Buda oil pump delivers a pressure of 40 lb. at 1000 r.p.m. of the crankshaft, and this is typical of other practice.

In oil pump practice there has been a little uneasy shifting around, both in the pump and in the drive. The Waukesha changed to a plunger pump a year ago, but came back to the gear device. Rutenber, on the other hand, has changed over from a vein pump to a plunger. The gear pump is in the majority, with the drive taken off the end of the camshaft. Oil leads are larger and as a rule are confined within the limits of the motor.

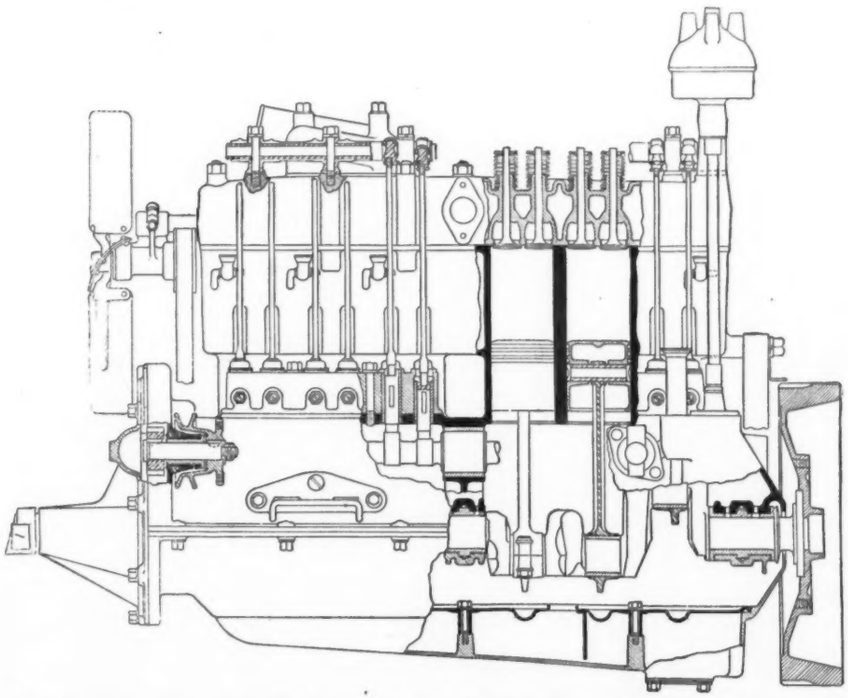
Some of the companies have simplified the oiling system to the extent of making it entirely self-contained. This has been a tendency for three years or more. The Wisconsin pump can be removed by taking four studs out of the bottom of the case. The Falls company has removed the external pipes this year and made the system self-contained. In the Le Roi engine there is a compartment surrounding the camshaft, which acts as a secondary oil chamber. It is 8 in. above the crankshaft and consequently gives that much hydraulic head for continually maintaining a supply in the splash troughs.

The matter of maintaining the oil in the splash troughs becomes very important in tractor work where a machine may be forced to operate on the side of a hill or constantly up-grade while it is running some stationary installation or, on the other hand, down hill. Waukesha has solved the problem of rectangular troughs, in which the scoop dips at the center or diagonal intersection of the rectangle. The scoop has been designed to give sufficient dip at any possible inclination.

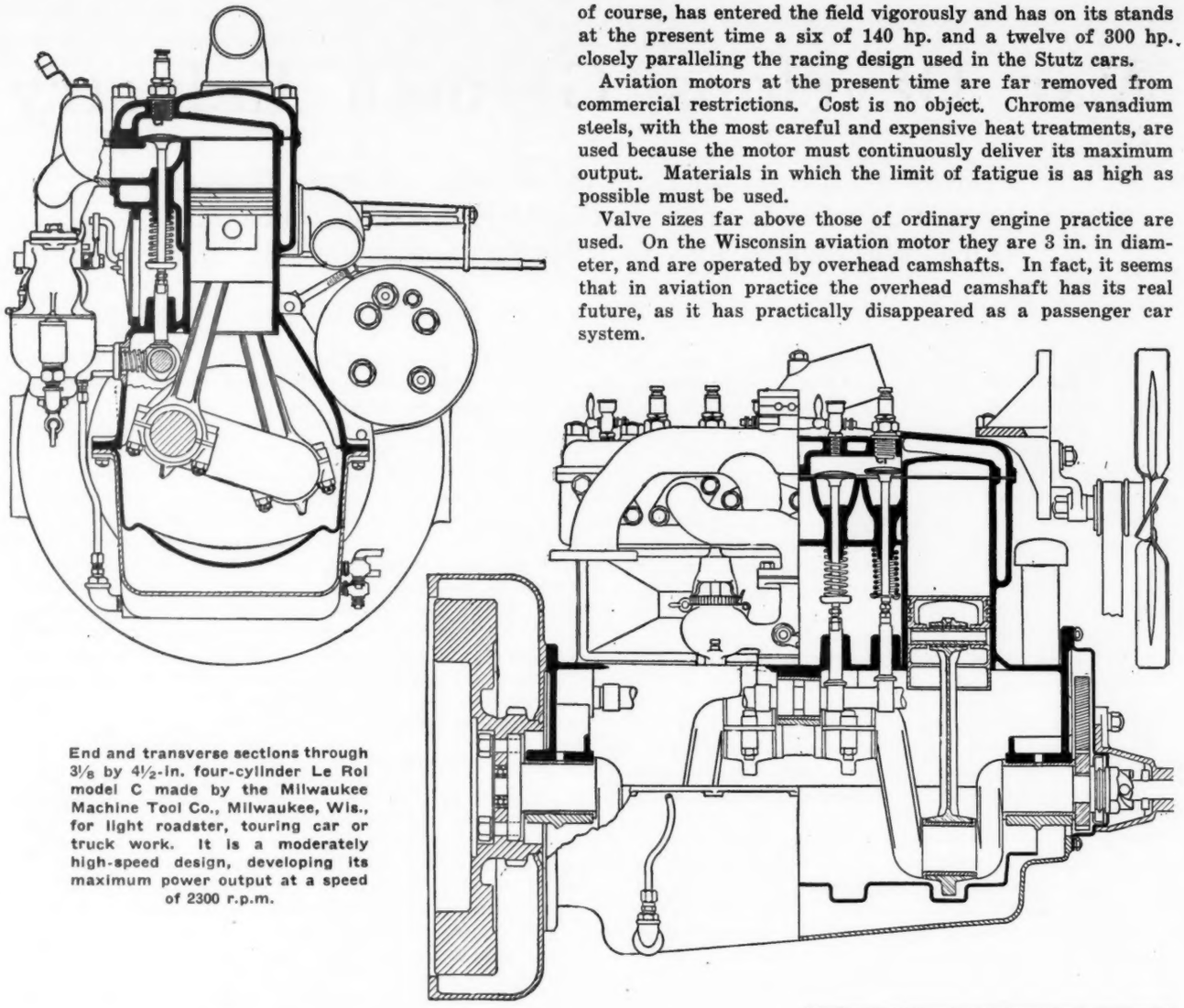
Dust filters must be used in the oiling system of the tractor engine. Particularly is this true in the breather. One engine uses two screens in the breather pipe, the top removable and the other stationary. The continual cloud of gritty dust that surrounds the tractor is its worst enemy, and although the grit cannot be altogether kept out, every precaution must be taken. Tractor motors must be entirely inclosed for this reason.

Aeronautical

All through the motor industry there is a feeling of preparedness in the direction of aeronautical work, Although motors are in such demand that prospective automobile manufacturers have gone from factory to factory begging for production, enough time has been snatched to give the aeronautical side of the question a little attention. Wisconsin,



Falls small six-cylinder engine which is intended for passenger car use. Like all the Falls motors, this has an overhead valve action and a very efficient form of combustion chamber which is clearly shown in the end cylinder



End and transverse sections through 3⅛ by 4½-in. four-cylinder Le Roi model C made by the Milwaukee Machine Tool Co., Milwaukee, Wis., for light roadster, touring car or truck work. It is a moderately high-speed design, developing its maximum power output at a speed of 2300 r.p.m.

of course, has entered the field vigorously and has on its stands at the present time a six of 140 hp. and a twelve of 300 hp. closely paralleling the racing design used in the Stutz cars.

Aviation motors at the present time are far removed from commercial restrictions. Cost is no object. Chrome vanadium steels, with the most careful and expensive heat treatments, are used because the motor must continuously deliver its maximum output. Materials in which the limit of fatigue is as high as possible must be used.

Valve sizes far above those of ordinary engine practice are used. On the Wisconsin aviation motor they are 3 in. in diameter, and are operated by overhead camshafts. In fact, it seems that in aviation practice the overhead camshaft has its real future, as it has practically disappeared as a passenger car system.

Schoenrock Uses Two-Diameter Piston and Two Sets of Valves

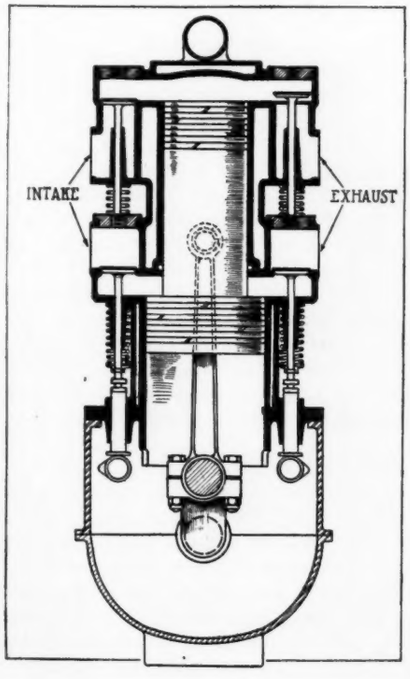
THE section at the right of the page illustrates the Schoenrock engine, which incorporates a novel adaptation of the four-cycle principle. The object of the engine is to secure the benefits of four-cycle practice with twice the number of expansion strokes. As will be seen, there is no great difference between this engine and any other except that it has a two-diameter piston, the smaller diameter being at the top and acting as the seal for the expansion chamber while the larger piston is at the bottom and is merely a factor in the scavenging of the engine.

Piston a Unit

There are two sets of valves, the upper left and lower left being intake and both right valves exhaust. The double piston is a unit so that as the gases are expanded they act upon the same rod, transmitting the power to the crankshaft. On exhaust the flow is very much the same as on the ordinary four-cycle engine.

May Be Rotary

In operation, as already stated, the engine has twice the number of expansion strokes, this being gained by the fact that while the small piston is compressing the gas the larger piston is exhausting the burnt gases. Although this drawing shows the engine with poppet valves it may be constructed with rotary or any other type. The intake valves are at the left of the cylinder block and the exhaust valves at the right, as indicated in the illustration. The connecting-rod mounting is also shown in the drawing.



War Develops German Industry

Necessity for Economy in Metals Makes Chassis Design Simpler, Stronger and Lighter—Lack of Rubber and Other Materials Brings Out Synthetic Product for Tires

By E. A. Langdon

GERMANY'S automobile industry has played a part of the utmost importance in enabling that country to withstand the assaults of its enemies since the beginning of the war. Needless to point out, this industry has not escaped the influences and effects of the great conflict and these results of the abnormal conditions created have been of both a detrimental and a beneficial character. For example, most of the cars which were drafted for service at the beginning of the war have long since been consigned to the army's great clearing houses for material, where they have been dissected and their various units used for other purposes or in repair work, or the rusty skeletons of their chassis, plucked bare of every detachable part and accessory, are gradually disintegrating in the mire of a thousand battlefields.

Chassis Are Simpler

Chassis construction has undergone a marked change, both in design and materials employed. Chassis are stronger and lighter, due to the elimination of many special parts formerly used, but now discarded for reasons of economy, and also because of the marked increase in the use of aluminum, not only for crankcases, gearboxes, etc., but also for such parts as valves, shafts, cylinder castings and other units for which an immense amount of copper, steel and iron was formerly required. A number of aluminum alloys of great strength has made this wide use of the metal possible, one of these alloys closely resembling the qualities of steel.

Gas from Coal for Fuel

An ingenious method of supplying automobile fuel has enabled the Germans to solve the gasoline shortage problem, which has at times remotely threatened to become serious since the beginning of the war, in spite of the enormous quantities of the fuel which Roumania practically made a compulsory condition to the purchase of wheat by Germany. Gas distilled from coal, and somewhat resembling illuminating gas in a liquefied or highly compressed state, is carried in steel tanks and fed to the engine through reduction valves.

One of the most important developments directly due to the war is claimed by the Germans to be the perfection of the manufacture of tires and other articles in which rubber was formerly used by synthetic processes. They also state that this product will compete successfully in quantity and quality with natural rubber in the world's markets following the termination of hostilities.

Industry Is Concentrating

German automobile, parts and accessory manufacturers, as well as the truck builders, are being fused into a powerful, compact unit of industry and are counting on their co-operative abilities to overcome trade barriers existing against their products at the end of the European struggle. It is even possible that agricultural and commercial motor trucks and tractors will represent a majority of the products of the industry for two reasons. One of these reasons is the large demand for these machines due to the scarcity of horses caused by the war, and the other is the economical advantage of standardized production.

Army Cars Different Now

The automobiles used by the army, at the present time, differ considerably from those used at first. Needless to state, there is hardly a car left which was drafted for service at the beginning of the war, except a few luxurious private cars used by the officers of the general staff and German princes. The supply of machines, however, must be replenished, and it is remarkable how, under the stress of necessity, German engineers have given up more and more special parts which went to make the machines as nearly perfect as their builders could conceive them; hence the cars are approaching an ideal of strength and simplicity, both in regard to design and materials used.

Aluminum Widely Used

The most striking feature, perhaps, is the immensely extensive use of aluminum, not only for crank and gear cases, but for valves, shafts, cylinder heads and jackets, supplanting a great deal of copper, iron and steel used before. The reason for the usefulness of aluminum is that the Germans have developed a number of very strong alloys, one of which is said to closely resemble the qualities of steel. The economic side of the matter is that the Germans mine coal belonging to France and to a considerable extent by French labor, and this coal enables them to manufacture tremendous quantities of aluminum cheaply by the electrical process.

This cheap production on a very large scale of coal has also aided the Germans to cope with their shortage of gasoline, as the gas obtained by distillation of the coal is used very largely to replace gasoline in stationary engines, marine engines, etc. This gas, which resembles liquefied or highly compressed illuminating gas in many respects, is transported in steel tanks from which it is drawn through suitable reduction valves. The reason for using this gas instead of industrial alcohol, which was used so widely in the early months of the war, is the necessity of economizing in potatoes, the chief staple food of the German people.

Synthetic Rubber for Tires

Rubber, the Germans say, will rapidly become a matter of the past after the war. All the tires used on German cars, as well as all the other rubber articles required by the Central Powers, are now made artificially, or rather synthetically. The Germans promise quite seriously that in the future their product will equal in quality and compete very successfully with Para and Ceylon rubber, and they never grow tired of repeating, with grim sarcasm, the fact that they are obliged to their enemies for forcing them to develop rapidly an invention which otherwise might have come along slowly in the course of years.

It has been stated above, and in some earlier article as well, that the Germans are organizing their industries more

and more on the "American," that is, the centralized, concentrated plan, and that by this means they intend to overcome whatever barriers they might have to break down in the market of the world when the war is over. This applies to the automobile industry as well, and in all likelihood, it will, after the war, face the world market as a solid combination, or "Kartell," as they call it in Germany—which is very little different from a trust. On the other hand, it is not at all impossible that the whole German automobile industry will devote itself to just one class of work, or chiefly so, namely, the building of trucks for agricultural and commercial uses.

The Need for Trucks

That the need for commercial motor vehicles will be even greater than for pleasure cars, after the war, follows simply from the fact that the stock of horses, with the exception of the breeding specimens, will be practically killed off by the time the war is over. Besides, the farming population, and especially the smaller ground holder, will be very much dependent on government support in every form, and as the subsidy policy for automobile trucks will doubtless be continued with even greater vigor than it was begun before the war, the incentive for buying efficient modern equipment will be correspondingly increased.

While the beginning of the war, or, let us say, the first 12 months, saw the introduction of many new devices and processes of warfare, such as movable siege guns, asphyxiating gases, liquid fire, electric barbed-wire entanglements and so forth, the number of innovations in war technique since the end of the first year have been rather small. The reason for this is not quite easy to understand, but, as several officers of the engineering branch of the German army have put it, is just about this:

Trying Out the New Things

"Germans, Austrians, French, and, in spite of their denials, British, have for years preceding the war invested an immense quantity of study and labor in the possibilities of the present war, and according to their ideas of the problems it would present, have worked out different schemes to overcome the difficulties they assumed they would have to face. Consequently, as the different ideas of warfare were given reality by the war's first year, the different inventions and discoveries and methods, either perfect or made so during that period, were brought into action. This introductory period being past, and the gravity of the struggle centering upon the Western field, methods had to conform to the situation given there. What is this situation? You may liken it to a game of chess on an immense scale, a game in which each player according to known ways of playing is capable of checkmating his opponent at the latter's first grave mistake. Hence the endless feeling-out and experimenting on both sides. Now and then, one or the other player believes to have found a new solution, but upon attempting to put it into practice finds, sooner or later, that he has not gaged the situation correctly. It is simply the impossibility of solving a problem of strategy by tactics. Therefore, whatever technical improvements one side or the other may bring out now, can be of but little bearing on the result. Both sides realize this, but the difference is that we are ready to express our understanding of the situation."

These words are almost verbatim what the writer learned from a high "genie" officer, now retired because of injuries. The interview took place in September, and the writer having obtained some English papers in Holland a few days before, asked the colonel above quoted: "How about the new British 'tanks'?"

The British Tanks

The officer stroked his long mustachio, and answered slowly: "It is quite a novel development, and its full efficacy cannot as yet be approximated. But if you want my opinion of the 'tanks,' let me tell you that on the Western front, two things count, men and explosives. Other devices are entirely minor. The men being required to serve the machinery of war, the rest consists in blasting to bits as much as possible of the enemy's position. Whatever is not an explosive is subject to destruction by explosives; and all we can tell after a few days' experience, so to speak, with the 'tanks', is that this maxim holds good in their case. They move slowly, at hardly more than 5 miles an hour, and that makes them splendid artillery targets."

I requested the colonel for a description of the "tanks."

"Mind you, this is far from being exact. Well: they are about 65 ft. long, almost 10 ft. high and not much narrower. The most striking feature is propulsion by endless steel lattices, engaged in the manner of chains by a set of driving wheels arranged on each of the axles. Steering is by a central pair of wheels placed like that of the old-time tricycles and arranged back of the machine. The power plant is situated close to this third wheel, entirely out of view from in front, and I conclude that the driver is guided by a sort of periscope eye placed in a well shielded position at the front of the machine. I doubt whether this engine weighs less than a 4:4:2 type of locomotive, and therefore would easily require 400 to 600 hp. for driving it. I know that Allied journals state the machine is like a railroad engine and carries its own rails along. But this is not so. These 'rails' are continually being laid over the most torn up ground imaginable, and the simile would be more correct if they would say that traction is by means of a pair of wheels, one on each side, with a theoretical spoke length of several hundred feet, but so actuated as to overcome the difficulty which this radius would cause if power were applied at the geometric center of the wheel. We have not as yet captured a 'tank', chiefly because when—as it happened in several cases—a 'tank' gets beyond control, it is blown to smithereens by the army of which it is part, so as to keep us from capturing it. Hence, you understand, all these statements are, so far as the construction is concerned, a matter of deduction. I should not be surprised, however, if these huge machines were driven, instead of by gasoline motors, by Diesel engines. By the way, isn't there a similar tractor made in the States?"

An American Prototype?

I failed to recall at the moment. The colonel gave me a merry look, like a schoolboy finding that there is one thing he knows and the teacher does not, and opened a drawer of his office desk. After a few seconds he handed to me a catalog of the Holt tractor factory! There was an illustration of what no doubt served as the original type for the "tanks," the caterpillar drive used on an American agricultural tractor.

The privates, "Kanenenfutter," who return from the trenches for a brief furlough to the "hinterland," are less easy about the new fighting machines. They maintain that when the "tanks" were first introduced, they made quite a terrible impression on the soldiers in the trenches, and it took quite a while until the suitable artillery could be got into readiness. But now the "tanks" are said to be a normal feature of the fighting like poisonous gases, and the soldiers with their marvelous faith in the ability of the army's rank feel certain that very shortly their effects will be quite checked and possibly beaten by a counter-invention. But there, the words of the engineering officer will probably prove true.

Friendly Toward America

A remarkable feature of the situation at present is the feeling toward America. The antagonistic sentiment which existed about a year ago has very much subsided, and the ideas then prevalent, about "*révanche*" toward America, for

supplying the enemy with ammunition and for restricting the submarine warfare, have almost disappeared, and by the intelligent Germans are passed over with a slight embarrassment. When you ask them about it, they say that they are so certain of their success in the end, that they will need their energies for something else than hitting back, after the war, at who might have harmed them during the war. The fact is, they realize that they will need very much raw material when the seas are open once more, and that it is no use antagonizing the people from whom you will have to buy most of it and who will find customers aplenty.

Big Tariffs in Europe After War

Of course, trade, like everything else, will be very different after the war. New methods will have to be used, both in buying and selling, and especially will the matter of credit and payment be altered. After the war, especially where such articles as automobiles, and particularly trucks, are concerned, a considerable part if not most of the business will be done on a basis of instalment payments from the consumer. In other words, American exporters here will meet a similar condition to that prevailing in South America, where payments are on long terms. It is not improbable that the same condition will apply to all of Europe, at least the Continent; and hence, exporting will call for more capital than it did before the war. Add to this the likelihood that every one of the European States or groups of States will surround itself by a tariff wall, and it follows that business with Europe after the war will be, although big, yet not an easy matter to transact, nor will it present any opportunities for the get-rich-quick type of business man.

Preparation Is Imperative

It would be well for the American automobile manufacturer who is at present reaping handsome profits to look into the future, organize his plant in the most efficient and economical manner imaginable, study the past methods required in trading with different European countries and educate their working, selling and advertising forces with a view to taking up the hard work of exporting when opportunity will present itself. In this regard, the parable of the wise and foolish virgins will once more prove significant, as it has proved so many times in the past.

Merchant Marine a Necessity

In closing, the writer would like to add one more thing which, though not of immediate automobile nature, should make American manufacturers think. American business men, not only in Germany and Austria, but also in Holland, Switzerland and Scandinavia are continually bemoaning the fact that there is so little of an American merchant marine with ships plying between the old and new world. They fail to see why their business, often enough in merchandise which cannot in any way be construed to be contraband, should be paralyzed and, as it was in many cases, destroyed, because nations other than their own are at war, and things seem to have come to the point where the belligerents force neutrals to look out for every one's interests except their own.

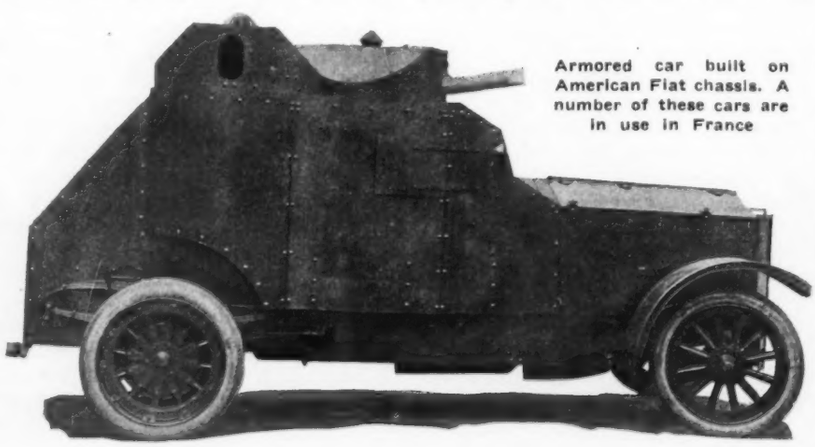
Fiat Armored Trucks in Battle Service

AMERICAN automobile chassis are numerous on the battlefields of France, both as the conventional passenger car and covered with armor plate. These armored cars are built both on motor truck and passenger car chassis, depending upon the character of the service for which they are intended. Thus massive, heavy chassis are used for field work where thick, weighty armor plate is a necessity, due to possible exposure to heavy fire and where speed is a secondary consideration. For swift, light armored types powerful passenger car chassis are frequently utilized, the plating not being as heavy since these cars are usually employed for scout work and quick dashes, so that they are not called upon to sustain heavy rifle or artillery fire for any length of time.

A number of the armored cars now in service in the Somme district and around Verdun are built on Fiat chassis produced in the American factory of the Fiat Co. at Poughkeepsie, N. Y. The illustration shows one of these Fiat armored cars. The motor is a 55-hp. type; wheelbase is 128 in.; transmission four-speed; and clutch multiple disk. In fact, the chassis with the exception of heavier springs, dual rear wheels, and the double steering controls, is identical with the model 55 passenger car chassis which the Fiat company is producing as its regular standard car. The chassis is equipped with the regular forward steering, so that the front driver operates the car as under ordinary conditions. There is a rear steering arrangement, so that the second operator facing backward at the rear end of the car can steer the car backward and have the car under the same control as the front operator—the advantages being that the armored car can run up as close to the firing line as desired, use the turret guns, and immediately back straightaway without having to turn around and subject the car to broadside firing from the opposing lines.

The radiator at the front of the car is armored with a V-shaped plate, so that any bullets striking will be deflected, without doing any damage.

On the chassis are mounted two rapid-fire guns in revolving turrets. Both the front and rear operator are protected by shields over the slits in the armor plate, through which they may look while under fire. The front operator has an opening, which is kept open when not in danger, but which can be closed down to the minutest point when approaching the firing line, giving almost perfect protection.



Armored car built on American Fiat chassis. A number of these cars are in use in France

The chassis is equipped with dual wheels rear, single wheels front. No air is used in the tires, so that puncture is not as serious as with air-filled types, the regular casing being filled with a special filler material adopted by the English government, although these tires are mounted on demountable rims for quick changing if necessary.

More News Is Wanted in Advertising

Value of a Good Name Considerable—Important That Price Be Stated—Foolish Catch Words Usually Disliked by Buyers

THE difference between American and British advertising is generally accounted for by the statement that the latter is "English," which explanation is given for anything and everything that the Briton does in his own way. But that the English ad reader is just as keen as his American cousin for attractive advertising and for ads that "tell him what the thing can do" and what it costs is indicated in a letter to *The Motor*, England, from one of its readers.

He advances the very modern thought that there is not enough sympathy between the advertiser and the prospective buyer, a criticism that is not necessarily confined to the British Isles. "One often wonders," he says, "whether the advertisers can regard their efforts from the standpoint of the buyer.

"The commercial value of advertising cannot be too highly esteemed. To be known is essential, and since first impressions have a peculiar adhesiveness, much—very much—depends upon one's introduction to some new commodity placed upon the market. Makers vie one with another to outdo in attractiveness, to excel in superior claims, to show their goods in the fairest light, and thereby eclipse the less-dazzling efforts of their rivals.

"Apart altogether from any commercial or speculative purpose, the scanning of the advertisement pages of such a paper as *The Motor* is full of interest, and one often wonders whether the advertisers can regard their efforts from the standpoint of the buyer, and whether they fully appreciate the effect upon the general mind. Sometimes one feels convinced that there is an absolute want of sympathy between advertiser and purchaser.

Must Attract Attention

"To attract attention to an article is the primary intention, and this may be accomplished in various ways. At the one extreme is the depicting of the absurdly ludicrous, freak forms and figures and faces, distorted and grotesquely abnormal features; but the effect of these, though at first they may succeed in drawing attention, is to repel; and probably every motorist could name a list of good and useful articles which are studiously avoided simply because of the advertiser's design which offended the sense of propriety.

"Just now, too, the figure of a man of good stature and military age at once arouses the thought that he ought to be at the Front and not soliciting a purchase of his goods. To rescue old gods from the backwaters of mythology and equip them in extremely modern guise adds no fascination to the goods they are supposed to adorn. It is always a risk to insert a face as a winning feature of an advertisement, unless that face have some peculiar charm or virtue. Some advertisers, not necessarily in the motor line, have ruined their chances of success by publishing abroad their own likeness. We often enjoy more fully goods, as also literary or poetic work, when we have not seen and do not know the manufacturer or author. Some geniuses in the factory and at the desk are insignificant to the eye. Nature, at times sparing in her natural and physical gifts, has bestowed vast stores of mental ability upon her unbeautiful children.

"An advertisement may be both attractive and pleasing. There are some we have turned to again and again simply because the illustration took pleasurable hold upon us, and, unconsciously, we became favorably disposed toward the thing itself. High art has been enlisted in this work of advertising, and a sense of gratitude toward the advertiser has led to the use of his—possibly—inferior goods to the complete exclusion of better things unhappily proclaimed.

"There are firms who cling to the idea that antiquity is still a virtue in the market, and largely declare their goods "The Original," even going to the extent of naming the date of birth or the age of the thing described; and the public, knowing that it is experience which teaches the most useful lessons of all, and that a hundred minds are ever busy in a more or less successful effort to improve upon any commodity which has attained to favor, prefer goods of the same kind whose making has no marks of antiquity.

"What's in a name?" is a stereotyped question; but there is more in the naming of an article than some makers think. It would not be a difficult task to draw up a fairly long list of articles which one would not care to ask for simply because their names are awkward or foolish. Give a thing a simple, straightforward, harmonious name and the battle is at least partly won. When people are uncertain how a word is to be pronounced, they hesitate to use it; and if that word be a foreign word, whose mispronunciation would be a mark of lack of education, educated people will shun it, even though it mean inconvenience and disadvantage to themselves, for fear of a slip.

"A man's own name is not by any means necessarily suitable for his goods. Who would not hesitate to inquire about the "Mary Ann carbureter" or the "Simple Simon tire?" The failure to appreciate things aright—a failure which is disastrous from the sale point of view—is shown in such nomenclature as the "Little Nell motor clog" or the "Tiny Tim differential grease." These may be fantastic exaggerations, but they have their counterpart in the advertisement pages of some journals.

"What the buyer really wants to know is the need that the goods will meet, claims that have borne the test, while one is also willing to accept with the usual scepticism the ambitious expectations of the makers. These have, however, been carried to such an extreme that the inquiry columns of many papers are full of requests for the experiences of disinterested users as to whether the advertised commodities actually fulfill the promise or claim of the advertisement.

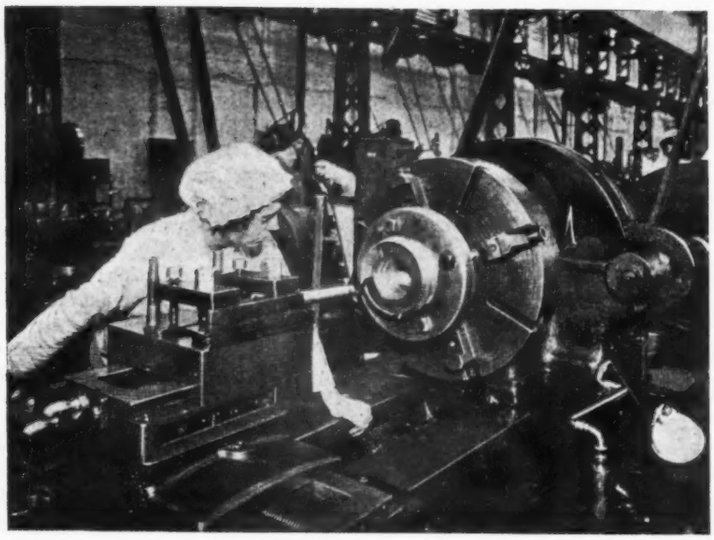
State the Price

"One thing more, and that is the price. Why cannot advertisers state the price of their goods? The withholding of this all-important factor is undoubtedly detrimental to the salesman. It creates suspicion. It is said that many shop windows show no prices on their goods because the sellers vary the price according to the apparent spending ability of the customer, or because the instructions are to ask at first too much in order to secure custom by reduction. These methods will not do to-day. We want to know exactly what a thing is to cost; we shall then know whether it will be worth our while to buy. The bartering of the Eastern fair is not according to the genius of the Western buyer. Advertisements count, advertising largely controls the market; but, after all, it is worth that wins, and the advertiser who gains a large sale by fraud or deception will suffer for it in the end."

Should Use More Female Labor

Automobile Manufacture Comprises Many Operations Which Can Be Performed Equally as Well as by Men —Hours Should be Shorter and Pay a Little Lower

By H. W. Allingham*



Cutting a large square thread

THERE are, in automobile manufacturing, many lighter jobs which could be done quite as well by women as by men. Such work should be paid for at a higher rate than it has been the practice to pay for woman labor, but at a slightly lower rate than men would expect for the same work, and the woman's hours should be a little shorter, perhaps 44 hr. a week where the men work 48 hr.

In showing how the above decisions have been arrived at it will not be possible to avoid repeating much which has already been published in the daily press and in weekly and monthly magazines. It is, also, not proposed to attempt to argue that the automobile industry is more suited to the employment of female labor than any of the other industries at present employing male labor almost exclusively. In fact, all the arguments which may be put forward in favor of the employment of women in the automobile industry, apply with equal force to a large proportion of the world's industries.

Until the European war forced upon the European nations a careful consideration of the possibilities of employing women, it had been the custom there, as it is at the present time here, to assume that certain classes of work were "men's work," simply because men had been customarily employed on such work since its inception.

A consideration of the question as to whether such an assumption is based on any logical reasoning shows that in the majority of instances it is not. Whether work is suitable for female labor or not is dependent on two main considerations.

(1) The manual effort required.

(2) The skill required.

Consideration of 1 needs no amplification. 2 should be analyzed further. In general it has been found that the more skilled manual work of the world must be planned on the assumption that male labor will do it. The reasons for this are as follows:

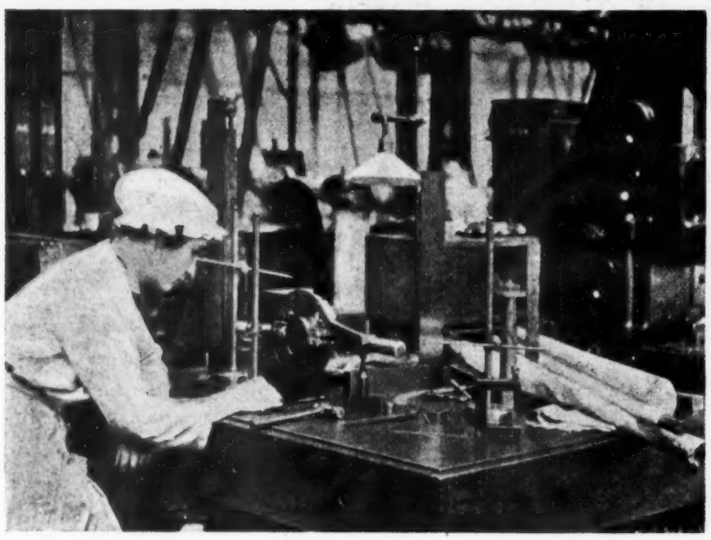
a. By virtue of the skill required, a more or less lengthy period of apprenticeship is required, during with the worker is an expense rather than a dividend-earner. It therefore follows that it is desirable to employ such people on skilled work as may be reasonably expected to remain active producers for a large part of their lives. This rules out women in general, because of the belief that they are more uncertain than men, practically never working after they marry.

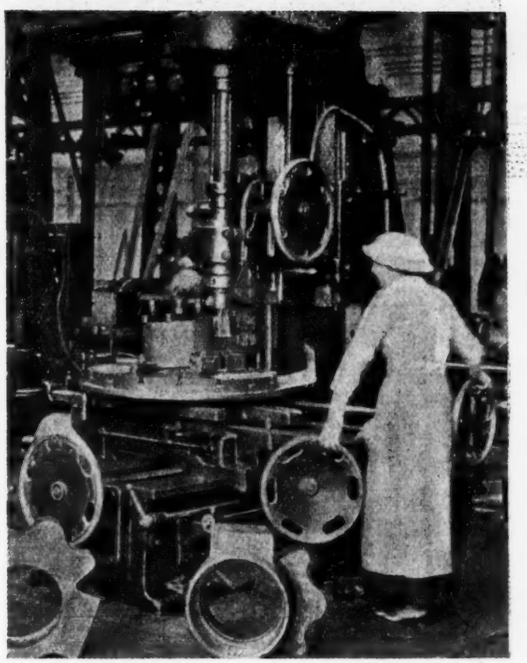
b. Ever since the inception of the "factory" systems less than 100 years ago men have banded themselves into unions which have tended to limit the employment of women, and of unskilled or semi-skilled men.

Mechanical engineering, covering foundry, machine shops, etc., has, in the past, almost without exception been looked upon as work suitable for men, although in the specialized industries, more particularly in the higher branches, women have been employed regularly for many years. Examples of this are light brass-finishing, core making, etc., while in the electrical trades much of the light work is now looked upon as women's work. The real difficulty is to determine how far it can be extended. For example, there can be no two opinions as to the fact that the machining of a 6-in. shell weighing 140 lb. is not suitable work for women, from the point of view of manual effort required, although it may be from the point of view of skill.

Performing surface grinding operation

*Mr. Allingham is a consulting production engineer with a very wide experience both in Europe and in America. He is especially well acquainted with the automobile factories of America and of England, while he has been able to study at first hand much of the work now being done by women in Europe.





Extremes of work. Above, the operator is illustrated engaged in marking off, and at the right in handling heavy parts

Again the operation of high-speed-steel hardening furnaces, or relieving lathes, can scarcely be expected to be sufficiently standardized, except in occasional instances, to be suitable for female labor. Nevertheless the writer in his own factories has been agreeably surprised to find women handled all the above work with every success, after careful teaching. The strictly logical line to follow would appear to be, firstly to determine what may be considered the limit for a woman in regard to manual labor, and then it becomes a question of balancing up the objections of trades unions and the difficulties of teaching.

Overcoming Objections

As an example of how male workers may be handled in this connection, I will give an instance which occurred in a factory where I was production engineer some 5 years ago. The department in question was the manufacturing milling department, and the labor regularly employed was of the semi-skilled or "machine operator" variety. Some of the work had increased in volume very greatly, and we had put in jigs holding, say, fifty small pieces, one jig being filled while the other was cutting. The work was light, and labor was scarce. Realizing that to start girls on these machines would be an innovation at that particular shop, and likely to cause trouble, I called a meeting of all the men involved, and asked them what their objections would be. They had all the usual objections and, of course, said they would not work if women were introduced. I went in detail into the orders in the department and through the capacities of the machines as shown by stop-watch time-studies (already this practice for setting rates was accepted by the men) and gave them one week to bring in their male friends to man the machines. If they could not give us the output required then, we should have the right to start women, *giving the preference to the men's sisters and friends.* The result was twelve women out of forty workers within a month, the women's work being carefully selected so as not to clash with the men's. No trouble was experienced and the men could not be rude or rough to their own relatives.

The average results of this and dozens of similar experiences can be set out briefly as helping to point the way to future developments. 1. Women will handle small delicate work of a repetition nature more quickly than men, giving a larger output per hour.

2. Women should work shorter hours than men. In general 8 hr. are quite enough, and a 44-hr. week, with Saturday a half day is my present ideal, just as the 48-hr. week is long enough for men working at an efficient speed.

3. The task per hour for women on light work should be as high as for men.

4. Rather heavier work can be tackled by women at a rather lower speed per hour.

It is doubtful, however, whether the need for women to undertake what I describe as rather heavier work would arise if they were regularly employed on light work. There is so much light work in the world at present done by men that this, at any rate, merits the first consideration. For instance, the custom in some countries of using women for snagging and fettling castings while men are doing plain light engine-lathe work in the same factory, seems to be quite wrong. The great increase in quantity production in the automobile trade has caused a splitting up of operations, and a state of standardization of small operations has been reached in many factories to such an extent that workers entirely unfamiliar with factory methods can learn to perform the operations quickly and skillfully in a very short time. When these operations are light and do not involve much strength, there would seem to be no logical reason why men should be employed in preference to women. Such operations include almost all the light machining operations on such parts for instance as valves, aluminum pistons, etc., and light assembling operations on units.

Light Machine Work Suitable

The classes of machines capable of being efficiently operated by women are the lighter varieties of drills, milling machines, plain lathes, punch presses, special continuous operation machines and hand screw machines; automatics are not among those recommended to be considered at first.

In regard to assembling, much of the electrical work and top making is now being done by women, and the extension of women to the other components would appear a logical step. For example, the assembling of the connecting rod and piston, of pumps, of carbureters, even of the differential gear and steering gear, would not on the face of it appear to afford any difficulties.

The question of the reduction of wages paid is an economic one, but must be mentioned here, as it will be one of the great

Women operators doing what was formerly men's work, shaping small parts and grinding in valves of truck engines

causes of objection to women labor on the part of the labor unions. The fact that women have received lower hourly wages in the past has been due to the fact that so large a proportion of female workers have not been entirely dependent on their wages, and also that a very much smaller percentage of women than of men have dependents on them. Thus a girl of 18, one of a family, goes out to work. She is living at home, and a wage of $7 a week is almost all pocket money to her and she would not trouble to join a union if there was one. From the above, many people argue that it is quite logical that women should receive lower wages than men, because wages are dependent on supply and demand.

It is this same supply and demand which has caused the writing of the present article. The supply of male labor is unable to meet the demand. This has caused the wages offered to increase out of proportion to the increase in the cost of living, but still we have the alternatives:

(A) Curtail output

(B) Employ women

(a) is unsound from every economic standpoint because it is tantamount to limiting the production of wealth. We are therefore driven to adopt (b).

Now comes the question: Is it best for the country at large that where male labor is replaced by female labor, the wages, or piece work prices, shall be the same as previously, in which case the costs will remain the same, or shall the wages be in accordance with wages paid to women doing work requiring similar physical and mental ability in other trades? If we pay the same wages as men, we may embarrass all the other industries employing women, while if we pay wages similar to those in other industries we cause dissatisfaction to the men previously doing the work.

Must Compromise

The writer's belief is that a compromise will be effected. The wages paid at present for semi-skilled or un-skilled work are proportionately higher than those paid for the highly skilled tool-makers, for example. The reason for this is that the semi-skilled work has been increasing at such a rate that operators could not be obtained without offering big rates. If the semi-skilled work be now subdivided into light and heavy, we can leave the rates for heavy as they are now, and the light work should be logically somewhat lower-priced. In addition, the total wages earned by a woman are reduced, if she works shorter hours than a man, as she should do.

On the other hand, I believe wages paid to women in the past have been lower than they should be, and the widow who has been compelled to try and keep her family on the wages she could earn has been in an almost impossible position.

To sum up; automobile manufacture has expanded so much of late that there is a distinct tendency to a shortage of semi-skilled labor. There are many branches of the work at present done by men which could just as well be handled by women. Women should work shorter hours than the men previously employed on the work. Wages should be slightly lower than those received by men, but not so low as were customary before the war. Finally, present war wages should not be taken as a criterion, although the shortage of male labor will continue after the war.

Women employed in an English factory fitting crankcases of large aviation engines. They are very successful at work of this character

Committees Manage Perfection Spring Co.

System Eliminates Individual Management of Departments—Administrative Committee Supervises the Other Twelve—Each Committee Meets at Least Once a Month—Duties Outlined

THE Perfection Spring Co., Cleveland, one of the largest spring producers, is operating its institution under a form of committee management installed during the past year as briefly mentioned in THE AUTOMOBILE several weeks ago. The system aims to eliminate individual management of each separate department and to substitute for it a supervision of the various departments by means of committees composed of officers and employees and arranged and controlled by the administration.

The administrative committee includes Christian Girl, president and general manager; W. E. Perrine, assistant general manager; P. A. Connolly, secretary; T. E. Borton, treasurer, and H. H. Newsom, works manager, and is the supervising committee over all, determining the other committees, their responsibility, range of supervision and the departments directly under their control.

There are in all thirteen committees which are classified as administrative, finance, sales, manufacturing, engineering, standard engineering, purchasing, safety, welfare and employment, patent, salaries, sport and recreation, and cost and efficiency. Their range of duties and composition are:

Administrative Committee—

Officers of company—Supervision of all committees.

Committee on Sales—

Sales department and road engineering department—reports directly to the president or assistant general manager.

Chairman—the president.

Committee on Manufacturing—

President, assistant, general manager and works manager—supervises standard manufacturing and new process and development work and reports directly to president or assistant general manager.

Detail prints and schedules for manufacturing shall be given the manufacturing department by the order department. This department shall have charge of the cost department with the chief cost clerk as its present head. Stock room and receiving department are under the direction of the manufacturing department. It shall handle all stock and tools entering into the production of springs.

Chairman—the works manager.

Committees on Engineering—

Research committee, standard engineering committee.

Research committee includes designing and analysis—consists of the head of the laboratory, head of the experimental spring department and others that the chairman might desire.

Standard engineering committee has as its duties the active work of designing springs in process of manufacture—consists of chief engineer, road engineers and inside engineers and reports directly to J. G. Utz, chief engineer.

Chairman—the chief engineer.

Committee on Purchases—

Composed of assistant general manager, secretary and works manager. Has as duties the purchasing and directions of all purchases. The purchasing department is in charge of Mr. Homan who is directly responsible to the committee. The department has one man assigned to the purchase of factory supplies and tools for the manufacturing department.

Chairman—Assistant general manager.

Committee on Safety, Welfare and Employment—

Composed of the secretary, assistant general manager and works manager.

It is the duty of the committee to take such action as will safeguard employees and eliminate or reduce accidents to a minimum.

The committee on welfare will assist and look after the welfare of employees and their families.

Employment committee shall pass upon and handle such employment problems as come outside the scope of the regular employment agent.

Chairman—The secretary of the company.

Committee on Patents—

Composed of officers of company and engineers.

Its duties are the supervision of the application and prosecution of matters referring to patents and the investigation of all patents submitted from outside sources to the company with the power to recommend purchase or rejection. Patent attorney expense is authorized by this committee and invoices audited by it. Patent department is in charge of the chief engineer who reports to the committee.

Chairman—The chief engineer.

Committee on Salaries—

Composed of president, secretary and assistant general manager.

Duties to handle all matters pertaining to salaries.

Chairman—The president of the company.

Committee on Sport and Recreation—

Consists of assistant general manager, secretary and works manager, and also the manager and assistant manager of each team.

Duties consist of arrangement for every kind of recreation such as baseball, bowling and other features which are financed by the company.

Chairman—The works manager.

Committee on Cost and Efficiency—

Composed of works manager, assistant general manager, secretary and two employees.

Duties consist of investigation into costs and efficiency systems.

Chairman—The works manager.

The president and assistant general manager are members ex-officio of all committees whether mentioned or not.

Any committee may appoint a sub-committee upon approval by the president or assistant general manager and all committees are governed by the general executive committee composed of the assistant general manager, who acts as chairman, and the sales manager, chairman of the engineering committee, chairman of the manufacturing committee and the chairman of the finance committee. It has charge of the execution of all matters pertaining to the sale and manufacture of the company's product as directed by the policy of the board of directors, which is represented by the president.

Each committee meets at least once a month and as much oftener as the chairman of the committee may demand.

System Is Satisfactory

The committee system has been in operation for several months and up to the present is giving excellent satisfaction. Many advantages have accrued including broader consideration of factory matters, elimination of any personal favor

that might possibly arise in the purchasing department, rapid determination of a balanced stock by the purchasing committee which thus permits placing purchase specifications for exact requirements when needed and avoids overstocking of material, increased and improved production, and economy.

The co-operation of the heads of departments working together in committee, thus effecting co-ordination of effort, is believed, by the company, to have produced maximum results with a minimum degree of labor.

Care has been taken not to destroy any of the good effects to be secured by decisions which are the result of careful study and analysis of the members of the different committees by a rule which forbids any employee of the company except the president or assistant general manager to change or cancel any decisions as rendered by a committee without first consulting the chairman of that committee. If in his opinion the change is of minor importance and not sufficiently of consequence to require a committee meeting he may authorize the change over his signature. Or if the suggested change is for betterment and is important he may submit it at once to the committee, as for example if a road engineer should attempt to change the design of any spring after the design has been approved by the engineering committee, he must first consult the chairman of that committee.

Final Salary Decision

No department head is allowed to promise or file application for an increase in salary without first consulting the chairman of the salary committee. And as an added assurance to the perfect operation of the system, and in order to place the responsibility for its conduct upon an individual, the chairman of the executive committee, the assistant general manager of the company, is given the veto power and final decision in all matters.

Thermoid Disk Coupling Replaces Steel

THE recent growth in popularity of fabric couplings immediately suggests the question as to why this material should be more satisfactory than steel. It will permit of a slight disalignment of the running parts, it is true, but so will a steel disk coupling, and yet steel has been replaced by the fabric in more than one instance.

A case in point occurred at the Mercer plant during the spring of 1914, when the present model 22-70 was being developed. E. H. Delling, who was at that time chief engineer of the Mercer company, was developing the experimental chassis. Originally the car was fitted with a large diameter flexible leather coupling between the clutch and the gearset, taking up all the play between the engine shaft and the main shaft of the gearbox.

Changes in the gear in the gearbox and the propeller shaft brake which was added necessitated a different type of joint in place of the leather. The leather had to be abandoned, as it was found that with the stresses that were added with the propeller shaft brake, it would not be strong enough in the small diameter that was required.

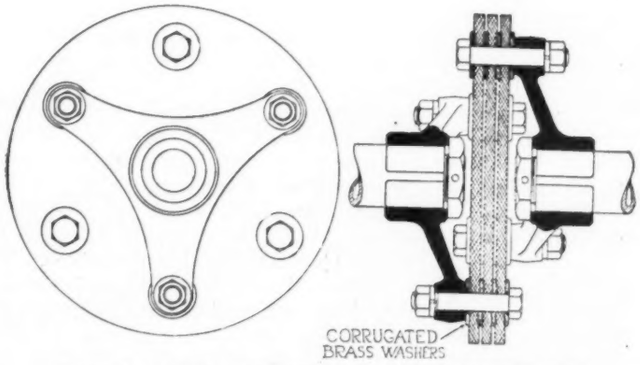
The three leather disks were replaced by two thin leaves of tempered saw steel on six or eight cars as an experiment. It was known that the strength of these leaves would be ample, but the uncertain part of the coupling was its action in practice and very soon after they were put on it developed that a rattle would occur. It took several days to locate this, as nobody suspected the coupling which was solidly bolted together. What made it particularly puzzling was the fact that the rattle would occur generally on direct drive and especially when running light or coasting. There was one peculiar feature and that is the rattle would never occur until the car had been run for 10 or 15 min.

The steel disks in the coupling were finally suspected, and to determine if they were really at fault they were removed and a fabric disk coupling made by the Thermoid Rubber Co. was substituted. Immediately the rattle ceased, and as a result of these experiments all the Mercer 1915 as well as the 1916 and 1917 cars were equipped with the Thermoid Hardy disks.

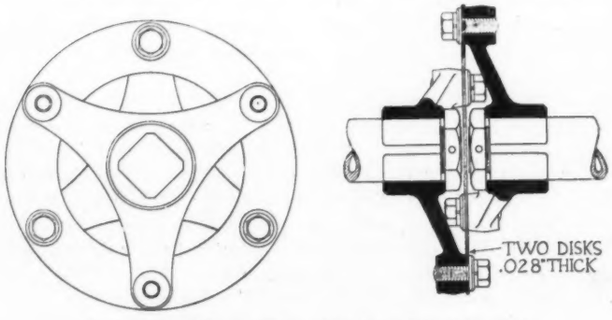
The laminated steel disk coupling which had to be abandoned is shown in the accompanying drawing. A three-armed dog is used on each shaft as a flange member and so arranged that the flange arms are bolted alternately between the arms of the flange on the opposite shaft. The flange members are secured to the shafts by squared ends and bolts which fit upon the ends of the shafts.

An investigation into what could have caused the noise in a coupling of this nature showed that it was due to a slight misalignment between the crankshaft and the mainshaft of the gearbox. This would cause a flexure in and out of the disks, similar to the action of a hand in pressing the bottom of an oil can, or in the disk devices that are used as a diaphragm in noise-making instruments. This in turn would transmit a torsional vibration to the gearset pinion whose teeth would naturally vibrate against the teeth of the countershaft gear, the clearance between the teeth being 0.004 in. The rattle would not show up for the first 10 or 15 min. until the grease would soften and cease to act as a cushion. After a little running the grease would thin out and thereafter the noise would be heard.

The Thermoid Hardy disks which replaced those of saw-steel are made under a patented process, of cross layers of high grade cotton fabric with rubber between them, and they are cured under compression similar to a tire. Their tensile strength is very high and is higher than that of leather as tests at the Columbia University have shown that couplings of the design illustrated which were worked out by E. H. Delling have withstood a torque of 21,000 inch-pounds before fracture.



Thermoid Hardy disk coupling for driveshaft mounting



Saw-steel disk coupling which was found to rattle

The Rostrum

Door Spring as Aid in Assembling

EDITOR THE AUTOMOBILE:—A few years ago when automobiles were built with the cylinders cast separately, it was not much trouble for two men to replace the cylinders after removing them. Now we have cylinders cast in blocks of from two to six and also piston rings with two and three parts, making it almost impossible for two men to assemble a motor, unless in an up-to-date shop, with all of the latest tools at hand.

For the benefit of those who have experienced trouble in entering the piston rings in a block of cylinders, where two or more pistons are entering at once, the best helper is a ⅜-in. screen door spring. Cut the spring into lengths, which, when stretched tight around the piston, will ride down with the cylinder, driving the rings into place without any trouble. The springs can be easily removed and used over, as soon as they have served their purpose on each piston.

Trenton, N. J. F. F. PALMER.

Data on Mean Effective Pressure

Editor THE AUTOMOBILE:—What is the brake mean effective pressure or the mean effective pressure of an internal combustion engine?

2—How can this be determined?

3—What is the pressure on the latest cars?

Orange, Cal. A. W.

—At the instant of explosion the pressure is very high and falls as the piston descends. The mean effective pressure is the average of the pressure existing throughout the firing stroke. Since a certain amount of power is used up within the engine and by friction the actual power delivered at the flywheel is less than it would be if figures from knowledge of what the mean effective pressure really is. We therefore take the mean effective pressure and multiply it by a decimal representing the percentage efficiency of the engine. Thus if the actual mean effective pressure is 100 and the mechanical efficiency 75 then the brake mean effective pressure would be 75 lb. per. sq. in. In actual engines this brake mean effective pressure varies between 60 and 100 lb.

2—When a horsepower test has been made the actual power delivered at a stated number of revolutions is none. We know this power comes from so many strokes of the pistons and of the impulse of the explosions. Knowing the area of the piston head and the length of the stroke we therefore know the brake mean effective pressure.

3—Answered under 1.

Troubled by Axle Shafts Breaking

Editor THE AUTOMOBILE:—I have a 30-hp. car with a semi-floating rear axle; the axle shafts are 1 5/16 in. diameter and at outer ends run in roller bearings which have a hardened steel sleeve 1¾ in. outside diameter, 1 5/16 plus bore which slips over the axle shaft and forms a bearing or inner race for the rollers.

The axle shafts frequently break off short at inner end of outer bearing and to remedy this I intend to have vanadium steel shafts made 1¾ in. diameter, dispense with the inner race of bearing and let the axle shaft run on the rollers. The rollers are of the high duty type and only about 2 in. long, so it is probable that the rollers would cut the shaft bad enough in a few thousand miles to require the replacement of the shaft.

Will it be safe and proper to case-harden the outer end of the axle shaft? I intend to do this by heating the outer end of the axle red hot in a bath of melted cyanide. Do you know of a better method? How long should the axle be left in the cyanide bath?

Should the axle be plunged in water after taking out of the cyanide?

My car is a 1913 Reo and it is easy to make the change in size of axle shaft without any large changes in the axle housing.

Carthage, Mo. F. B. N.

—You should have no difficulty in repairing the axle in the way you suggest. It would probably be unwise, however, to attempt to harden the vanadium steel shaft by the method you mention as this will almost certainly make the end very brittle. You do not say whether you are equipped for accurate heat treatment. Suppose you used a 0.3 or 0.4 carbon chrome vanadium steel, this should be quenched at 1650 deg. Fahr. and drawn at 850 deg. Fahr. The shaft should be gradually tapered from the back of the bearing down to the place where it fits in the differential hub. A somewhat easier heat treatment perhaps would be available if you used 3½ per cent nickel steel of a 0.3 to 0.35 carbon, allowing this to cool slowly after forging, heating then to 1550 deg. Fahr., quenched in order to reheat to about 650 deg. Fahr., allowing it to cool slowly in the air after this last heating.

Wiring Diagram of Wagner System

Editor THE AUTOMOBILE:—Kindly give wiring diagram of Wagner 12-volt starting and lighting system on 1913 Moon 48 roadster.

Wilmington, N. C. R. W. M.

—Wiring diagram of Wagner 12-volt starting and lighting system used on 1913 Moon is illustrated in Fig. 1.

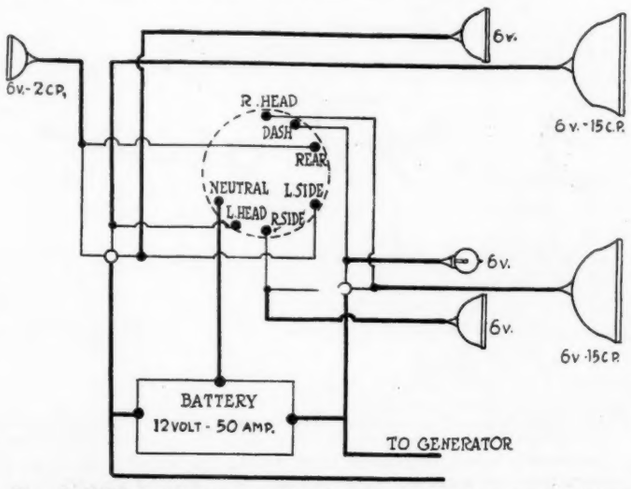
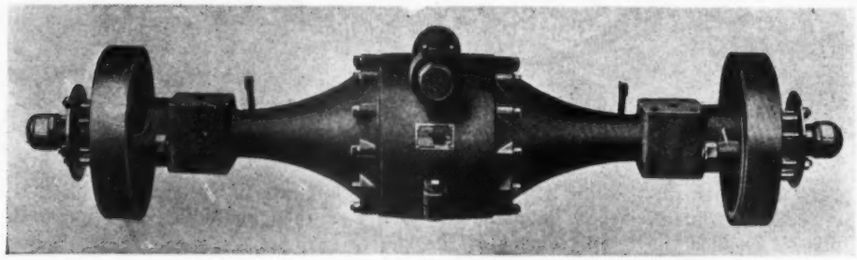


Fig. 1—Wiring diagram of Wagner 12-volt starting and lighting system on 1913 Moon 48 roadster

Empire 1-Ton Axle Has No Differential



The new 1-ton worm-driven axle made by the Empire Axle Co., Dunkirk, N. Y. It is characterized by the fact that it has no differential and is the first stock axle to be so offered on the market in this country. The housing is of the three-piece type, following previous Empire practice. The central part of the housing carries the worm and wheel as a complete unit

Central Part of Three-piece Housing on New Truck Type Carries Worm—Brake Shafts Oiled from Inside

NO differential is fitted in the new 1-ton worm-driven truck axle just brought out by the Empire Axle Co., Dunkirk, N. Y. This is the outstanding feature of the new axle, which was designed primarily for use by trucks of 1-ton capacity to sell at less than $1,000 and for converting passenger-car chassis into trucks of 1-ton burden. It is the only stock worm-driven axle so far to be placed on the market in which the almost universally adopted differential has been eliminated.

Advantages claimed for the use of a solid axle without a differential are that better traction is obtained over snow and bad roads, less tendency toward skidding when the brakes are applied, greater tire mileage and an appreciable reduction in the weight of the axle assembly itself.

The elimination of the differential enables a live axle to be used which is sufficiently strong to carry the weight and take the drive. This means that the casing for the worm gear need only be strong enough to support the driving stresses without any weight-carrying function. The elimination of the differential and the resultant decrease in the weight of the necessary housing makes the new axle light and simple.

The axle is designed to take both the propulsion and the torque through the springs, and is provided with a three-piece housing which follows previous Empire design. The center housing carries the worm and the worm wheel as a complete unit.

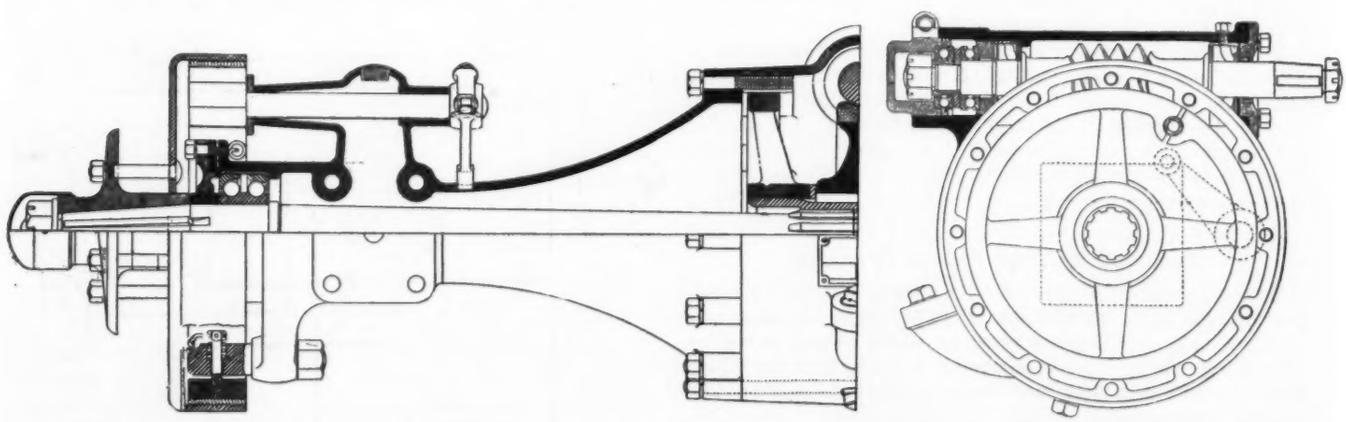
As shown in the sectional view, the complete housing is open from end to end and is characterized by a new construction in which the brakeshaft bracket is hollow and in open communication with the interior of the remainder of the housing, thus insuring the brakeshafts a sufficient quantity of oil for lubrication.

The worm and worm wheel are of the straight type. The worm is of 3½ per cent nickel steel, case-hardened and then ground to the correct tooth form. The worm wheel is cast from special phosphor bronze of high tensile strength. It is cut by the hobbing process, thus producing a generated tooth.

The driveshafts are of chrome nickel steel, heat-treated and ground to size. They are of the three-quarter floating type and are supported at the wheel ends on double-row radial-and-thrust type ball bearings, as is shown in the left of the section. As shown at the right of the section, the worm thrust is taken by double heavy-duty ball thrust bearings and the radial loads by two roller bearings of the Hyatt type.

The brakes are internal-expanding, with drums 13½ in. in diameter and 2¼ in. wide. The spring pads, which are integral with the side housings, are cubical in shape and hollow, forming the open interior connection between the housing proper and the brakeshaft supports. The spring centers are 38 in. apart, and are designed for springs 2½ in. wide.

The tread of the axle is 56 in. and the ratio between the worm and the worm wheel is 7.2 to 1. The axle is designed for a rated load of 3550 lb. on the tires, including chassis, body and live load.



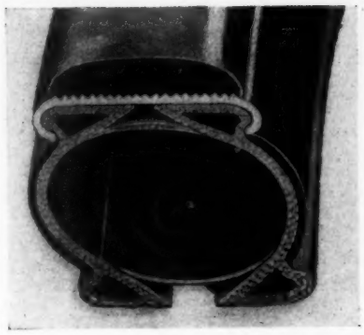
Longitudinal half section and section through the worm carrier of the new Empire 1-ton axle which has no differential and which is designed for use on trucks of that capacity to sell at less than $1,000. Note that the spring pads are cubical and hollow, and that the brake shafts are lubricated from within the housing through the open communicating passage formed by the hollow spring pads. Also note the straight worm and how it is carried on thrust ball bearings and straight roller bearings for the radial load. The axle is of the three-fourths floating type, mounted on double-row radial-and-thrust type ball bearings at the wheel ends

ACCESSORIES

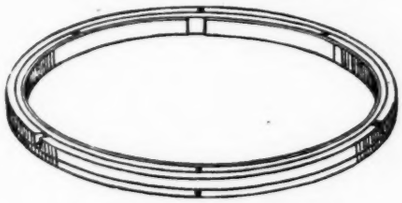
Big 4 Tire

SEVERAL radical departures from conventional tire construction embodied in the Big 4 include construction in three parts, any one of which may be replaced if damaged, unusually low air pressure required and, according to the manufacturer, positive puncture-proof and well-nigh trouble-proof qualities. The tire consists of two side walls and a non-skid tread rim, an idea of the construction in which these units are assembled being given in the accompanying illustration. With this tire it is necessary to carry only spare side walls and tubes instead of complete spare tires. The tread rim is claimed to be exceedingly durable and the replacement of the tread or one or both of the side walls is much less expensive than to buy a new tire. Only 25 lb. pressure is required for a 34 by 4-in. size, as compared with 80 lb. for an ordinary tire of these dimensions.

The company also manufactures tires for truck use which are claimed to give the same high resiliency as the ordinary pneumatic tire and also the uninterrupted service and durability as the solid type. A non-skid tread rim is also made for winter service on the truck tires. —Big 4 Tire and Rubber Co., Cleveland, Ohio.



Section through Big 4 tire, showing the two side walls and the tread rim



Chopa compound piston ring

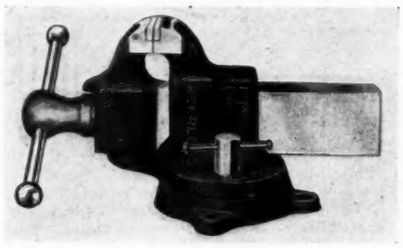
Chopa Piston Ring

This is a compound gray iron piston ring made of several sections overlapping in a manner said to prevent leakage. Because of the compound construction an even pressure is exerted on the cylinder walls and the ring will accommodate itself to worn pistons, it is claimed. Price, each, 3¾ in. diameter or under, $1; 4¾ in. and under, $1.25; 5¾ in. and under, $1.50.—Chopa Piston Ring Co., 264 East Jefferson Avenue, Detroit.

Pillsbury Hubpul

This is a combination hubcap, wheel puller and a device for pulling the car out of mud holes. It is made exclusively for Ford and Model 490 Chevrolet cars. The hub pull is quickly attached to each rear wheel of either of the cars above mentioned by simply unscrewing the original hubcap and inserting the device in its place. It may be left on permanently if desired, and, as it is neatly designed and nickel-plated, does not detract from the car's appearance.

The rubber-covered special hooks which attach to a rope are hooked around the spokes the rope wrapped once around the hub, then carried forward or backward from the underside and anchored to a stake, telephone pole, tree, post or any stationary object; the motor is then started and the wheels slipping causes the cable to be wound, which pulls the car gradually out with much greater leverage than could be obtained with the motor on ordinary traction. The device may also be used for removing wheels from the rear axle without stripping threads. The price per set is $6.—Pillsbury Mfg. Co., Minneapolis, Minn.



Fulton Peerless machinists' vise

Fulton Machinists' Vise

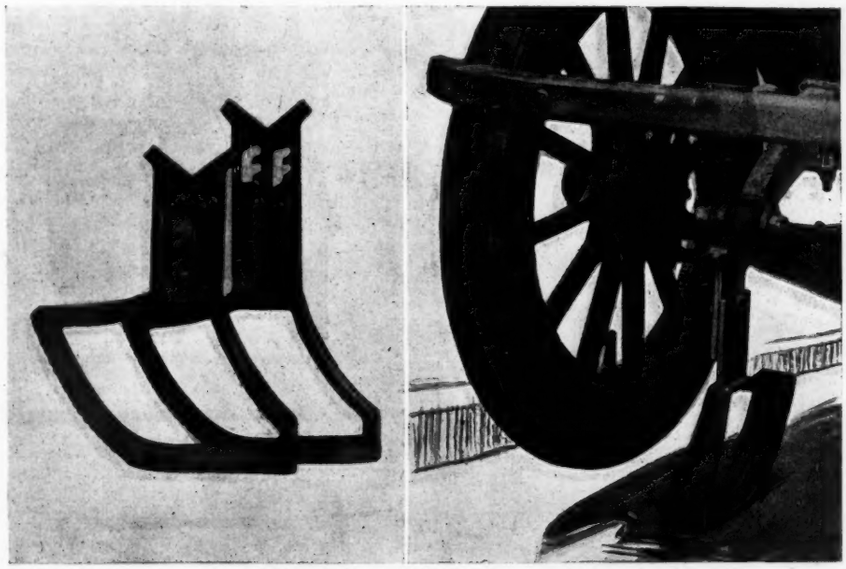
This light weight swivel base vise is suitable for the repair shop. The jaws are cast steel welded onto the face of the vise, giving a very strong construction. The vise may be swiveled to any desired position and firmly locked by a taper head bolt. Price, No. 295, with 3-in. jaws, $7.50; No. 31, with 4-in. jaws, $10.50.—Fulton Machine & Vise Co., Lowville, N. Y.

Rotary Jack

As shown in the illustration, this jack is inserted under the axle and the car driven ahead slightly so that the axle and wheel are automatically lifted up on the jack which is built on the rotary lever principle. The device is composed of two main parts together with an adjustable pillar for axles of different heights. The jack is made of malleable iron and weighs 7 lb. It sells for $2.50. —Rotary Jack Mfg. Co., 340 Moore Building, San Antonio, Tex.

Waynelight Headlight Regulator

The Waynelight is a small transformer designed to steady the headlight illumination of Ford cars. The current passes from the magneto through the trans-



Left—Two views of the Rotary jack, showing upper and lower extreme adjustments. Right—Rotary jack in use under a car axle

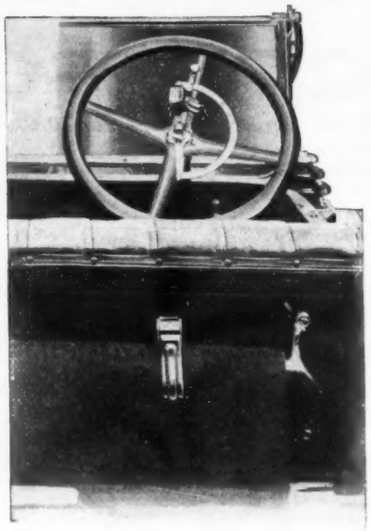
former to the lamps, which are wired in multiple. Such wiring prevents the possibility of both lamps going out, as is the case with the usual series winding. It is claimed that the transformer furnishes a steady light at all speeds above 10 m.p.h. The installation is simple, it being only necessary to substitute 6-volt lamps in place of 9-volt lamps, attach the present headlight wire to one of the magneto terminals of the transformer, and ground the other transformer terminal to the frame. A pair of wires, each connected to a lamp, extend to the two lamp terminals of the transformer. The Waynelight may be placed on the dash, under the hood or floorboards, or wherever it is most convenient. Price, $3.65. —General Electric Co., Fort Wayne, Ind.

Spotlight Push Switch

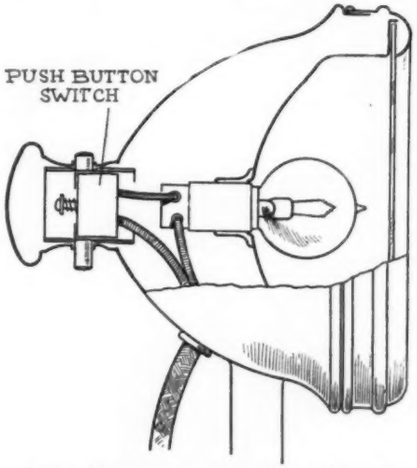
This push-button switch placed in the neck of the spotlight permits the hand that directs the rays to also control the current. Two buttons project from the switch—one black and one white. Pressure on the white button causes the lamp to light, if out; the black button is used to shut the lamp off. The switch is insulated by means of a fiber sleeve, and the push-buttons are put in place in the switch after it has been placed in the small neck of the lamp.—Cutler-Hammer Mfg. Co., Milwaukee, Wis.

Compound Air Compressor

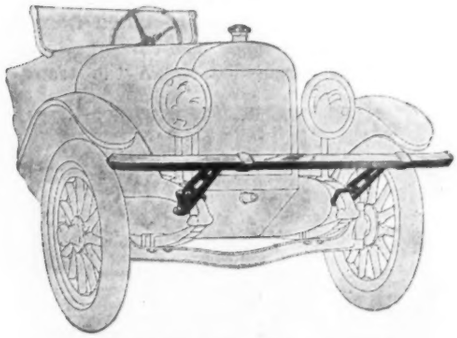
Air is taken into the large cylinder of this twin-cylinder air-cooled air compressor and compressed to about 50 lb. per square inch; at this pressure, and at about one-quarter of its original volume, it is delivered to the small or high-pressure cylinder, which compresses it to its final pressure. This system is claimed to give higher efficiency, to require less power and to reduce the wear on the parts. Belt drive is used, either from a general power line or directly from a motor. In this last case the motor is mounted on four uprights at the top of the compressor, making a very compact arrangement. Complete installations, including steel air-storage tanks of any capacity, are handled.—United Engine & Mfg. Co., Hanover, Pa.



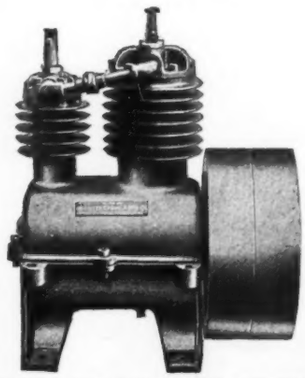
Backus Utility baggage lock



Cutler-Hammer push button switch for spotlights, showing connections and mounting in the lamp

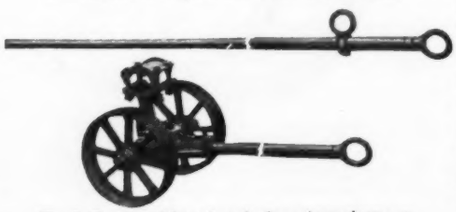


Badger two-piece spring bumper



Compound twin-cylinder air compressor

Waynelite transformer for Ford headlights



E. & S. wrecking truck for clamping underneath the axle of a disabled car for the purpose of towing

Utility Luggage Lock

Luggage may be locked to the roberail or foot-rest with this lock. Two steel fingers may be closed together and locked, securing the articles to the car. For example, gloves or coats may be clamped to the steering wheel, a suitcase may be locked to the foot-rest or the control levers may be fastened to the steering-wheel quadrant, thus preventing the theft of the car. Two keys are supplied with each lock. Price, $1.—Backus Novelty Co., Smetheport, Pa.

Badger Spring Bumper

The Badger two-piece spring steel bumper is designed for indestructibility and may be fitted to almost any car. The cross-bar is made of high quality spring steel specially tempered, though very resilent to cushion a shock, is sufficiently stiff to protect the parts. The bar may be adjusted to any angle desired. Price, $12 with 2-in. nickel bar; $10.50 with black bar.—Auto Parts Mfg. Co., Chicago, Ill.

E. & S. Towing Truck

This is a wrecking truck that may be clamped beneath the axle, thus supporting the car and permitting it to be towed in. Two 14-in. wheels with an 18-in. tread are mounted on a malleable iron frame that has an adjustable upright clamp that may be bolted to the axle. Two towing poles are included, one 10 ft. long for a rear axle break, and one 5 ft. long for front axles. All bearings have grease cups and the total weight is 160 lb. Price, $27.50.—Ellis-Smith Mfg. Co., Buffalo, N. Y.

Edison Lamp Assortment

A display box of assorted sizes of Edison Mazda lamps has been brought out to aid dealers in their sales work. The assortment is the minimum stock which any dealer should carry and will enable him to meet the lamp requirements of 90 per cent of all the gasoline and electric cars for 1914, 1915 and 1916. The lamps are arranged in an attractive container and a list of the lamps carried is printed on the cover of the container.—Edison Lamp Works of General Electric Co., Harrison, N. J.

Industrial Miscellany

Factory

Jenkins Machine Co., Sheboygan, Wis., has been purchased from W. W. and Louis Wolff by A. G. Studeman, formerly an executive of the Falls Machine Co., Sheboygan Falls, Wis., and Mark Hoeper, until now assistant treasurer and purchasing agent of the J. I. Case Plow Co., Racine, Wis. The Jenkins company is capitalized at $70,000 and will not change its name or capital for the present.

Osborne Casting Co., Racine, Wis., recently organized, expects to take occupancy of its new 15-ton gray iron foundry on Jan. 1.

Burnell Fuel Saver Co., Milwaukee, Wis., has been organized by A. A. Giese and A. J. Melms to manufacture carburetion auxiliaries and similar appliances for the automobile trade. The capital stock is $10,000.

Nu-Way Puncture Cure Co., capital stock $20,000, has been organized in Green Bay, Wis., to manufacture a fibrous compound for automatically sealing punctures. R. C. Moore is the inventor. Offices have been opened at 403 West Walnut Street, Green Bay.

Four-Wheel Drive Auto Co., Clintonville, Wis., is spending approximately $20,000 in new tools and equipment for additions now being completed. It has a standing order for twenty trucks per week for an indefinite period, and is now producing four a day. By Jan. 1 the output is to be six a day.

Commercial Body Co., Trenton, N. J., manufacturer of bodies for automobiles, has acquired property at 809 South Broad Street for an addition to its plant.

Perfection Tire Co. will commence work soon on the erection of a plant at Niagara Falls, Ont., for the manufacture of tires and rubber goods.

Packard Motor Car Co. has acquired additional property in Long Island City, adjoining its present plant, on which it will erect an eight-story building, more than doubling its present facilities.

International Rubber Co., South Bend, Ind., maker of automobile tires, is pushing the erection of its new plant in this city. The building will be completed by Dec. 12. Half of the brickwork on the building, which will be 382 by 80 ft., is already done. The building with its equipment involves an expenditure of about $200,000. The plant is located on the Vandalia tracks and Edwin Boulevard, in the southern part of the city. The company has established 1500 selling branches.

H. W. Kardell, president of the Kardell Motor Car Co., plans to build a factory in Alton, Mo., to build a motor plow.

Simplex Automobile Co., New Brunswick, N. J., has opened the Simplex Recreation League. The old Middlesex Club house in Highland Park has been transformed into club quarters for its employees. The league was organized by the directors of the company for the benefit of the men who are employed at the plant and their families.

McCord Mfg. Co., Wyandotte, Mich., will build an addition.

R. H. Reynolds & Co., New Albany, Ind., is erecting an automobile woodstock plant, combining two factories now at Corydon and De Pauw, Ind.

Personal

J. K. Stewart, of the Stewart-Warner Speedometer Corp., Chicago, Ill., has purchased 2½ acres of ground on Jackson Avenue, Long Island City.

M. D. Randall heads the Randall Motors Corp., New York City, to handle the wholesale and retail distribution of the Grant.

G. F. Blake has been appointed district sales manager of the Auburn Ignition Mfg. Co., Auburn, N. Y., maker of the A. I. M. Auburn and Blazer spark plugs and valve lifters.

H. H. Cobe and **C. F. Coe** have joined the Burd High Compression Ring Co., Rockford, Ill., organization in Boston, Mass. Mr. Cobe has been in the automobile field since 1903, being connected with the Haynes, Locomobile, Jackson, Palmer Singer and G. & H. Carbureter Co.

W. J. McKechnie has been appointed general manager of the American Forging & Socket Co., Pontiac, Mich. He was for 4 years chief accountant of the Rutenber Motor Co., Marion, Ind. The American Forging & Socket Co. makes forgings and bow sockets for automobile makers.

C. E. Collard, formerly Philadelphia branch manager of the Chase Motor Truck Co., and C. N. Gillette, Southern division sales manager in the same organization, have both severed their connections with that company to become associated with the Selden Truck Sales Co., Rochester, N. Y. Mr. Collard becomes division sales manager in the Philadelphia territory, while Mr. Gillette assumes the same position in the Southern terri-

The Automobile Calendar

ASSOCIATIONS

Nov. 22—Boston, Mass., National Assn. of Automobile and Accessory Jobbers' Meeting.

Dec. 2-9—Electricians' Country-wide Celebration.

Jan. 9—New York City, National Automobile Chamber of Commerce, Annual Banquet at Waldorf-Astoria.

Jan. 9-11—New York City, Society of Automobile Engineers Mid-Winter meeting, Thursday, Jan. 11, S. A. E. day. Annual Banquet, Hotel Biltmore, Special performance Ziegfeld's Midnight Follies.

Jan. 10—New York City, Motor and Accessory Manufacturers' Banquet, Waldorf-Astoria.

Nov. 16—New York City, S. A. E. Meeting.

Nov. 23—Philadelphia, Pa., S. A. E. Meeting.

CONTESTS

Nov. 16 and 18—Santa Monica, Cal., Vanderbilt Cup and Grand Prix Races.

Nov. 18—Phoenix, Ariz., 100-mile free-for-all Track Race. Arizona State Fair.

Nov. 24 and 25—Newark, N. J., 24-Hr. Endurance Run of N. J. Automobile and Motor Club.

Nov. 30—Uniontown, Pa., Speedway Race.

Nov. 30—Los Angeles, Cal., Ascot Speedway 200-mile Championship Race.

1917

April—Los Angeles to Salt Lake City Road Race.

May 19—New York Metropolitan Race on Sheepshead Bay Speedway.

May 30—Indianapolis Speedway Race, Championship.

June 9—Chicago, Ill., Speedway Race, Championship.

June 23—Cincinnati, Ohio, Speedway Race.

July 4—Omaha, Neb., Speedway Race, Championship.

July 14—Des Moines, Iowa, Speedway Race, Championship.

July 28—Tacoma, Wash., Speedway Race, Championship.

Aug. 4—Kansas City Speedway Race.

Sept. 3—Cincinnati, Ohio, Speedway Race, Championship.

Sept. 15—Providence, R. I., Speedway Race, Championship.

Sept. 29—New York, Speedway Race, Championship.

Oct. 6—Kansas City Speedway Race.

Oct. 13—Chicago Speedway Race.

Oct. 27—New York Speedway Race.

SHOWS

Nov. 10-18—Providence, R. I., Show, Rhode Island Automobile Dealers' Assn.

Nov. 20-25—Worcester, Mass., Show, Worcester Casino; Worcester Automobile Dealers' Assn.

Dec. 2-9—Springfield, Mass., Show, Auditorium. H. W. Stacey, Mgr.

Dec. 18-20—San Francisco, Cal., Automobile Salon De Luxe, Palace Hotel I. R. Gates, Mgr.

Dec. 30-Jan. 6—Cleveland, Ohio, Sixteenth Annual Show, Wigmore Coliseum, Cleveland Automobile Club.

Jan.—First Pan-American Aeronautic Exposition, New York City; Aero Club of America, American Society of Aeronautic Engineers, Pan-American Aeronautic Federations.

Jan. 6-13—New York City, Show, Grand Central Palace, National Automobile Chamber of Commerce.

Jan. 9-10—Fort Dodge, Ia., State Convention, Iowa Retail Automobile Dealers' Assn.

Jan. 20-27—Detroit, Mich., 16th Annual Show, Detroit Automobile Dealers' Assn.

Jan. 22-27—Rochester, N. Y., Show, Exposition Park, Rochester Auto Trades Assn.

Jan. 27-Feb. 3, 1917—Chicago, Ill., Show, Coliseum, National Automobile Chamber of Commerce.

Jan. 20-27—Montreal, Que., Automobile Trade Assn.

Feb.—Newark, N. J., Show, First Regiment Armory.

Feb. 3-10—Minneapolis, Minn., Show, Minneapolis Automobile Trade Assn.

Feb. 10-18—San Francisco, Cal., Pacific Automobile Show, G. A. Wahlgreen, Mgr.

Feb. 18-25—St. Louis, Mo., Show, Auto Manufacturers' and Dealers' Assn.

Feb. 19—Pittsfield, Mass., Show, Armory. J. J. Callahan, Mgr.

Feb. 19-24—Syracuse, N. Y., Show, State Armory, Syracuse Dealers' Assn.

Feb. 26-March 3—Omaha, Neb., Show; Auditorium, Omaha Automobile Show Assn.

March 6-10—Boston, Mass., Show, Mechanics' Bldg., Boston Automobile Dealers' Assn.

March 6-10—Ft. Dodge, Iowa, Northern Iowa Show, New Terminal Warehouse, G. W. Tremain, Secretary.

March 14-17—Davenport, Ia., Show, Coliseum Bldg., Tri-City Automobile Trade

tory, with headquarters at Charlotte, N. C.

J. F. Hill, who has been manager of the Splitdorf Service & Sales Co. branch at Kansas City, Mo., for the past 4 years, recently resigned his position and will open a garage business at Waterville, Me. His successor as manager at Kansas City is O. J. O'Donnell, recently with the Chicago office of the same company.

Newell Lyon, for 3 years general sales manager of New York State for the White Co., has been made manager of the Kansas City branch of the company, recently established after purchase of the Kansas City White Co. from J. H. Toole. Mr. Toole is now taking a vacation and his future plans are not announced, although he may be connected with the branch.

N. L. Le Blond, formerly secretary and general manager of the Hannibal Motor, Wagon & Body Co., Hannibal, Mo., has been made Western manager of the Dearborn Motor Truck Co. and will make his headquarters at Kansas City. Augustine Gilmore, formerly of Chicago, succeeds Mr. Le Blond in the Hannibal company as general manager, Miss Hattie Salee being made secretary.

A. D. Plughoff has resigned as vice-president and general manager of the Willys-Overland Co. of California and as vice-president of the Overland-Pacific, Inc. He is leaving San Francisco immediately for an extended trip through the Eastern factories before announcing his future plans. He has been connected with the automobile trade for 18 years, having been associated with J. W. Leavitt when he handled the Overland on the Pacific Coast.

W. L. Burgess, St. Louis, manager of the tire and tube department for the Dorris Motor Car Co., has resigned to become sales manager for the Sterns Tire & Tube Co., that city.

W. F. Kneip, manager of the Franklin Motor Car Co., Baltimore, Md., has been elected president of the Baltimore Automobile Dealers' Assn. C. H. Reeves, Jr., of the Foss-Hughes Co., was elected vice-president, and E. S. Bliven, of the Standard Motor Co., secretary and treasurer.

E. T. Backus, who came to Baltimore, Md., on Aug. 1 and assumed charge of the headquarters of the Ford Motor Co. in this city, has been appointed one of the three assistants to N. A. Hawkins, general sales manager of the Ford company, with headquarters at Detroit. Mr. Backus was in charge of the Ford branches in Dallas and Houston, Tex., before coming there. A. A. Grisham, assistant manager here, succeeds Mr. Backus as manager of the Baltimore headquarters. K. G. Harig, a Baltimorean, who was in charge of the State wholesale department, becomes assistant manager. H. W. Ford will be the successor in Mr. Harig's old place.

H. O. Foskitt has been placed in charge of the Jackson Motor Co. branch at Lawrence, Mass.

W. R. Dudley, St. Louis, manager of the Vesta Battery & Equipment Co., has been transferred to the Chicago branch as a traveler, and is succeeded by F. G. Fulkerson, formerly of Cleveland.

F. E. Miles has become purchasing agent of the Lewis Motor Corp., Detroit, Mich. Mr. Miles was formerly connected with The National Motor Vehicle Co.

Z. B. Leonard has resigned his position with The Perfection Spring Co., Cleveland, Ohio. He was formerly head of the laboratory.

Floyd Robinson of 251 Putnam Avenue, Detroit, advertising manager of the Regal Motor Car Co., Detroit, Mich., was seriously injured recently when he was struck by a motorcycle. His skull was fractured. Later reports are that Mr. Robinson's condition is much improved.

E. J. Warren, formerly general manager and treasurer of the Crosby Co., Bangor, Me., will open in January his new store, the Auto Supply & Rubber Co., on Post Office Square, with a full line of automobile accessories and rubber goods.

Dealers

Fisk Rubber Co., Philadelphia, has arranged to lease a four-story building which will shortly be erected at 664-66 North Broad Street at a cost of $100,000.

Henry A. Rowan, Jr., Co., 2036 Sansom Street, Philadelphia, has taken over the agency for the Smith Form-a-Truck.

Ramey Motors Co., Philadelphia agent for the Hal, has moved into its new showroom at Broad and Brown Streets.

Garwood Motor Car Co., 2248-52 Euclid Avenue, Cleveland, Ohio, has been organized to distribute the Pathfinder in northern Ohio.

J. R. Flannery, Jr., formerly of Stillman & Hoag, has entered into partnership with Wm. C. Brightly, Englewood, N. J., to conduct a garage and general machine shop under the name of Brightly & Flannery, Inc.

Standard-Racine Rubber Co., Oneida and Jefferson Streets, Milwaukee, distributer of Racine tires and a general line of accessories, will build a new tire and accessory store at Astor Street and Juneau Avenue, on a corner site measuring 175 by 135 ft. The present quarters will be continued as a general accessory and supply house.

Jesse A. Smith Auto Co., 215 Wisconsin Street, Milwaukee, State distributer of Hudson cars since 1911, has taken a long-term lease on the Welch garage building, Grand Avenue and Seventh Street, which has just been vacated by Harry Newman, Inc., former Chalmers distributer. It is one of the largest buildings in Milwaukee devoted exclusively to automobile distribution, being four stories high and containing nearly 50,000 sq. ft. of floor space.

Weber Implement & Automobile Co., St. Louis, Mo., has taken the Maxwell agency and the Brinkmann Motor Car Co. has withdrawn from business, its affairs being liquidated. Coincident with this, G. C. Brinkmann, former president of the Brinkmann Motor Car Co., filed a voluntary petition in bankruptcy in which his liabilities were given as $32,198 and his assets at $87, of which $5 was cash.

Aniser Mfg. Co., St. Joseph, Mo., has changed its name to the Mechanical Belt Co. and is now marketing the Crowe fan belts exclusively. This product will be sold through the jobber.

Willys-Overland Co. has opened a show and sales room at 71 Broadway, Yonkers, N. Y.

Motor Car Sales Co., Bloomington, Ill., has broken ground for a new garage. This structure will be located at 406-410 West Washington Street. The company will utilize the building as a sales agency for the Chalmers and Dodge.

J. W. Leigh Motors Co., St. Louis, has leased space in the Plaza Hotel building at 3302-3304 Locust Street as headquarters for the Apperson.

Paul Crawford, Birmingham, Ala., State agent for the Chandler, has opened his new salesroom at 406 Twenty-first Street.

Spangler-Tubbs Motor Co., Boston, has been formed to handle the Metz.

Stockyards Garage, Denver, is the name of a new business opened at East Forty-seventh Avenue and Lafayette Street to deal in accessories. The manager is A. J. Mosley.

Rocky Mountain Auto Sales Co., a new concern at 204 Sixteenth Street, distributer of Auburn cars and Gladiator tires for Colorado, Wyoming and part of Nebraska and South Dakota, has added the Regal distributing agency for Colorado and half of Wyoming.

Roberts Auto Co., Denver, Marmon distributer for Colorado and Wyoming, has moved from 220 Sixteenth Street into a new $20,000 building at 1231-1239 Broadway.

George H. Estabrook, Denver, is now the business name for the Briscoe and Hollier distributing agency for Colorado and Wyoming, formerly conducted as the Briscoe Auto Sales Co., of which Mr. Estabrook was president. The location is still 1646 Broadway.

Mulford Bros., Streator, Ill., have opened the old Halladay garage, corner of Kent and North Sterling Streets, and will carry on a general business in the repairing of automobiles and sale of supplies.

Tioga Automobile Co., Philadelphia Hupmobile dealer, has sold out to a firm headed by Robert McCormick, who was formerly in charge of sales for Hurley & Early, this city. The new company is looking around for larger quarters, and is at present located at 332 North Broad Street.

Richwine-Haines Co., Philadelphia, has leased the showroom at 719 North Broad Street, where it will handle the Liberty car. The territory includes Pennsylvania, New Jersey, Delaware and Maryland.

The Thomas-Bonner Co., accessories, electrical goods, etc., 152 Sixth Street, Milwaukee, has been released from bankruptcy litigation instituted in September. Creditors have caused the action to be dismissed and the business will be continued without interruption.

E. E. Williams and Clarence Heiderscheid, proprietors of the Kingdom Garage in Hardin, Ill., dissolved partnership, the former purchasing the interest of the latter. Mr. Heiderscheid remains in Hardin and will devote his time to the Ford car agency and service station. He has let the contract for a new garage and sales agency on Main Street.

Garber & Habecker, Washington, Ill., have dissolved partnership. The former will continue the garage and sales agency, while Mr. Habecker will occupy the W. H. Long building and will open a garage and sales agency of his own. Mr. Garber will continue to handle the Ford car, while the other lines previously handled by the firm will now be in charge of Habecker.

Moerschell Electric & Auto Supply Co., St. Louis, announced that H. E. Q. Kuhn, factory expert on Rayfield carbureters, has joined that company to handle Rayfield business.